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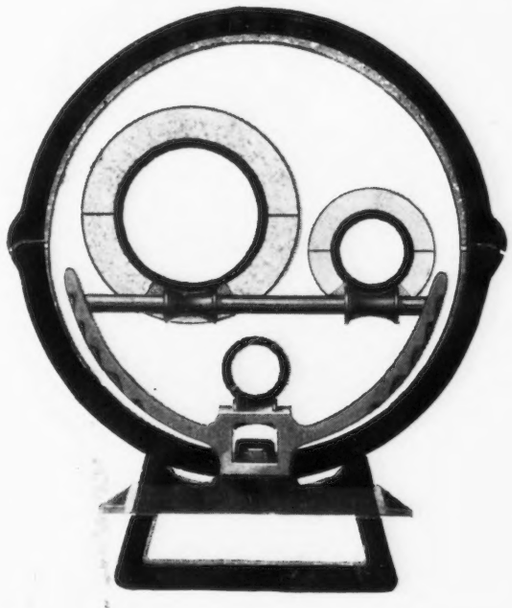

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The Heating and Ventilating Magazine

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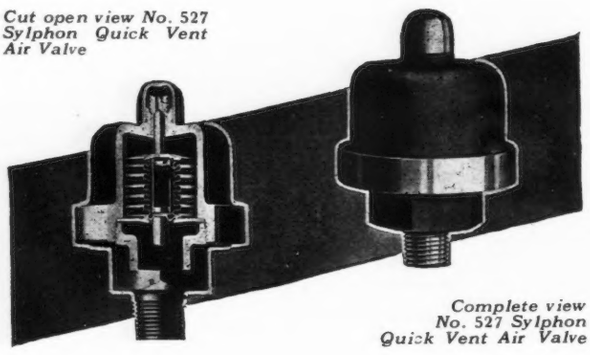

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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress.

SEPTEMBER, 1923

High Spots in the Saving of Fuel

Some of the Practical Measures Which Can Be Applied to Meet the Present Crisis in the Coal Situation

By Edgar C. Molby

Molby Boiler Company

IT IS necessary that all users of coal should use every effort to reduce the consumption of fuel. This does not mean that the householder should suffer from cold, but that he should so regulate the burning of coal as to utilize every possible B.T.U. from the coal burned in the heating of his house.

The only way to conserve fuel is to make it go further, that is, get the best out of it by the best possible combustion and heat absorption in the boiler. In the building of a home the architect, builder, and house-owner should all unite in seeing that the house is reasonably well built and tight and that the chimney flue to which the boiler is attached is adequate for the burning of the amount of coal necessary to heat the building to the required temperature. No one factor, as far as combustion and the results obtained from the fuel are concerned, compares with that of the quality of the draft. The chimney requirements for various types of heating apparatus are admirably set forth in many publications and in the model ordinance recommended by the National Board of Fire Underwriters.

LOW BIDS NOT THE PROPER CRITERION.

It goes without saying that the capacity of any heating plant depends upon the number of B.T.U. it is capable of delivering. Any amount of heat supplied above that required represents a loss. How unreasonable it is, therefore, to select an installation in accordance with the low bid, rather than upon the efficiency of the proposed plant. It costs very little more to install a good plant than a poor one.

PROPER SUPERVISION OF THE INSTALLATION REQUIRED.

The heating contract should be a separate contract between the owner and the heating contractor and should never be let by the owner or architect in the general contract, unless it is thoroughly understood and specified that the plant is to be installed under proper supervision. After the plant is installed, explicit instructions relative to its operation must be given and the apparatus arranged so that adequate control of temperature can be maintained.

BUILDING CODES SHOULD PREVENT LEAKY BUILDING CONSTRUCTION.

Not only should the combustion and efficiency of the heating plant be subject to strict laws, but the building code should be sufficiently stringent to prevent the leaky construction of buildings. Some buildings, as everyone knows, are so poorly built that it requires a great deal more coal to heat them than would be necessary under careful inspection and under an adequate building code. When poor chimneys, leaky windows, poor walls, a roof through which the wind whistles down between the studs to the cellar, make a veritable ice box of a house, it is time to look into the enforcement of the building code and probably to revise it.

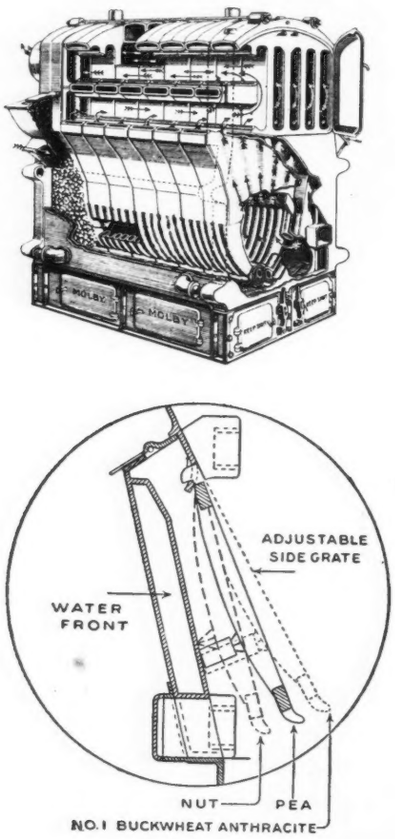
STANDARD OF EFFICIENCY NEEDED IN BOILER CONSTRUCTION.

A standard of efficiency in boiler construction enacted into building codes would be a long step forward in saving fuel. As we have seen, a certain number of pounds of coal must be burned to efficiently heat any given space. A boiler with small grates and small heating surfaces requires forcing, with consequent losses on account of high temperatures in boiler and stack. A high temperature in the chimney shows loss, and so does a leaky and inadequate chimney.

DEPLORABLE FEATURES OF THE PRESENT HOUSING BOOM.

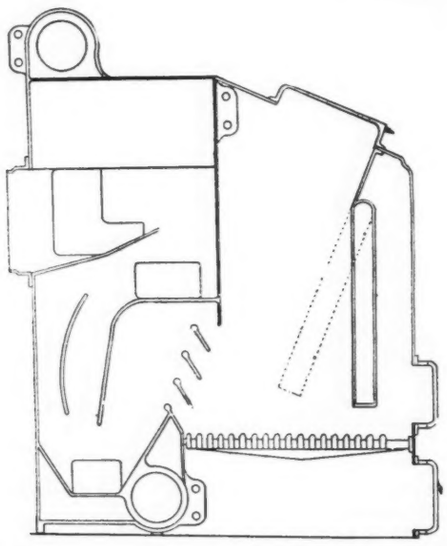
It is to be regretted that the so-called "smokeless" boiler cannot be sold at as low a price as the ordinary boiler for, at the present time, the thousands of homes being built, for instance, in suburban New York, are all being equipped with the cheapest kind of boilers, boilers

which are grossly overrated and which require large quantities of coal to maintain any rating. In most cases the conditions surrounding the plants are bad, the chimney flues leaky and of poor construction, so that the purchaser of one of these houses is obliged to buy more than his share of coal and the highest-priced coal, at



Adjustable Side Grate of Molby Boiler for Burning Various-Sized Coal.

that, on the market. He cannot use a smokeless boiler, for his chimney is not sufficient to give him fair results with the ordinary type of boiler, burning large coal. Pea and buckwheat are out of the question, because he would have to stay home from business to keep the fire going.



How the Wayne Boiler is Arranged to Provide for a Movable Magazine Front.

DEFECTIVE CHIMNEYS THE BANE OF THE INDUSTRY.

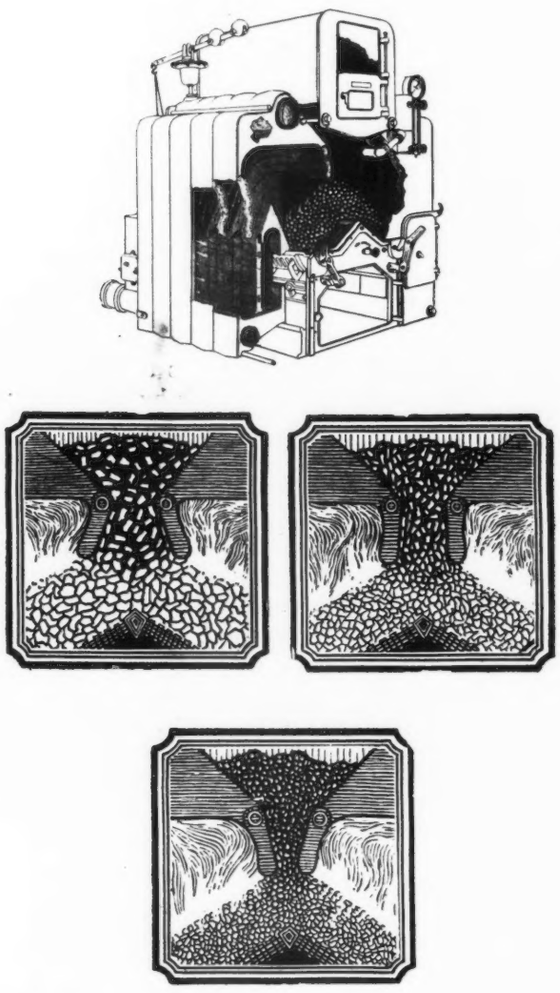
The fact is, there are few boilers installed out of which the owner secures proper results, due to defective chimneys. There are many boilers heating houses and other buildings from which about one-half of their true capacity is utilized because of faulty chimneys. Moreover, the fact that a boiler heats a house does not prove that the chimney is good, but the better the chimney, the better the economy.

ADVANTAGES OF THERMOSTATIC CONTROL.

Heating plants should have the best kind of automatic regulation. Besides saving fuel, thermostatic control has the added advantage of maintaining comfort.

BUCKWHEAT COAL AS A SOLUTION OF THE FUEL PROBLEM.

Perhaps the greatest opportunity for reducing the cost of heating lies in the use of a boiler which will burn the



Construction Details of Newport Boiler Showing Adjustable Grate Feature.

smaller sizes of anthracite without the need of a blower. The chimney requirements, of course, in that case, are especially vital. It is a fact, however, that a boiler of this type is capable of saving from 40% to 60% of the fuel cost for any given installation.

Several years ago the anthracite people were selling their buckwheat coal to power plants. This was called steam coal, but in the past few years the different manu-

facturing plants have switched over from buckwheat to bituminous coal, and some of them to oil. The steamship companies, which were using steam sizes of anthracite, are now burning either bituminous coal or oil.

The result is that there is today very little demand for buckwheat. In fact, there is such a surplus of it that practically any quantity can be delivered on order.

One of the principal sources of fuel waste last winter was the fact that the coal retailer was obliged to take buckwheat in proportion to his other purchases. He, in turn, forced it upon his customers, who were not prepared to burn this coal or did not know how to burn it. It was put on the fire, passed through the grates and was thrown out in large quantities with the ashes.

Some customers kept it piled up separately and left it. Others fired it in quantities and could not keep their fires going, due to insufficient air for combustion. Wherever it is possible to adapt boilers to burn this fuel, it will not only relieve the houseowner of his worries over the coal situation but will be a practical step in promoting economy and at the same time, of conserving the general coal supply.

High Efficiency of By-Product Coke

At a time when thousands of householders are pondering the problem of next winter's fuel supply, the Department of the Interior calls attention to the results of tests recently made by the Bureau of Mines which demonstrate the high efficiency of by-product coke. Test conducted by the Bureau at its Pittsburgh and Minneapolis experiment stations with different types of steam boilers suitable for heating 7 or 8-room houses recorded as high efficiencies with by-product coke as with anthracite. The efficiencies obtained with Pittsburgh and Illinois bituminous coal were 8% to 20% lower than those obtained with coke.

The anthracite used in these tests was a mixture of egg and nut sizes and was considerably cleaner than that ordinarily obtained in the Pittsburgh market. The by-product coke test at Pittsburgh was of domestic size, made from a mixture of several coals from the Klondike region near that city. The by-product coke tested at Minneapolis was of domestic size and made from eastern coal.

With the same attention to the fire, the Bureau of Mines found that coke gives much more uniform temperature than bituminous coal. In addition, coke is a clean fuel and makes neither smoke nor soot, an advantage difficult to express in exact figures. It is nearly as good a fuel as the domestic sizes of anthracite, and if anthracite is unavailable at reasonable prices a by-product coke makes a good substitute.

Domestic fuel should preferably be clean and smokeless, and should keep the house at an even temperature, with little attention to the fire. Anthracite suitably sized possesses these properties to a large degree and has been used for this purpose for a long time, particularly near the anthracite mines. Many thickly populated districts are so far from these mines, however, that anthracite can be obtained only at a high price, and the bituminous coal that is available is not so clean and requires more frequent attention to the fire to maintain a uniform temperature.

The Coal Situation and its Possible Effect on Heating Methods

The coal situation at the present time is somewhat different from what it was a year ago. There has been plenty of coal mined this year, just as there was last year. In 1922, however, we had to contend with a shortage of cars and labor troubles on the railroads. There was plenty of coal at the mines but it was not being delivered. This year we have plenty of coal at the mines and it is being delivered.

A large proportion of the domestic consumers of coal have their winter supply of fuel in their cellars and there will be no coal stringency such as we had last year. In the meantime, the retail coal dealer is reaping a harvest from his advanced prices and is furnishing the oil man with the finest kind of arguments for the adoption of oil burners in domestic boilers. Hundreds of oil-burner outfits have been placed in boilers during the past summer and this industry will be greatly expanded on account of the attitude of the coal people who do not seem to realize that they are hurting their own best interests by their present policy.

The cost of heating by oil at the present price per ton of coal is, in many cases, less than coal and that being so, the houseowner has only to consider the first cost of installation. A large proportion of the oil burners which have been installed seem to be giving satisfaction and it is altogether likely that this fact will result in placing the coal man on the defensive shortly.

Again, the anthracite coal people have lost many of their customers through market conditions and have permitted bituminous coal to be substituted in thousands of places. One evidence of this is that there is no more anthracite coal mined at the present time than in previous years, although the reasonable demand for domestic coal has increased each year, due to the thousands of new homes. In addition to the adoption of bituminous coal, this increase in demand is being taken care of by oil and manufactured gas. There are also some electrical installations being made.

As is now generally known, the conservation of fuel would be greatly advanced if coal were coked and the various by-products of the coke taken out and used, and the coke adopted as a domestic fuel. The great power of coal when it is divided into its different parts and sold separately would create a tremendous increase in the world's wealth, for, at the present time, in the direct burning of coal in heating plants, these by-products are wasted.

Coke is a good fuel and can be used in almost any heating outfit. This use of coke would greatly reduce the cost of heating on account of the saving in freight and handling, and on account of the sale of the by-products. It has been stated that "a million tons of coal will produce 7,000,000,000 cu. ft. of fuel-gas, 3,000,000 gal. of benzol for use in motors, 16,000,000 gal. of fuel-oil, 700 tons of coke for domestic heating and 9,000 tons of sulphate of ammonia for the manufacture of fertilizer and high explosives."

Steam Savings by Automatic Control in Large Buildings

Adaptability of Heat Regulators of the House-Service Type in a Variety of Structures Including Hotels and Office Buildings, Supplied with Central Station Steam

By B. L. Boalt
Steam Control Department, Minneapolis Heat Regulator Company

IT IS an established, although perhaps not a well-known fact, that heat regulators of the type used in homes and residences, consisting of a single thermostat and motor, are capable of efficiently controlling large buildings heated by central station steam. It is apparent, of course, that in an installation of this kind the same temperature cannot be maintained in every part of the building, as the thermostat is usually placed in the hardest part to heat. The primary function of the regulator, in such cases, is to prevent overheating by shutting off the steam as it enters the building, when enough heat is supplied.

The facts and figures here presented are furnished through the co-operation of the Northwestern Electric Company of Portland, Oregon. As conditions and problems elsewhere are the same, the facts apply generally. The installation of automatic thermostatic control in office buildings, apartments, hotels, hospitals, warehouses and residences, where central steam is used, in almost every case shows a saving. These savings vary, depending on the consumption of steam with direct regard to the size of the building.

An examination of the recapitulation chart (Fig. 1) brings out the following facts:

A. Column 5—Estimated consumption against hand control. Eight buildings show more steam used than estimated (875,000 lbs.). Two buildings used less than estimated (820,000 lbs.). In five new buildings no comparison can be made as hand control was never used.

B. Column 6—Estimated consumption against automatic control. Seven buildings show greater consumption than estimated (705,000 lbs.). Eight buildings show a saving of 2,465,000 lbs.

C. Column 7—Hand control against automatic control. Eleven buildings where hand control was previously used show a saving of 1,628,000 lbs. Adding to this the saving of automatic control on the five new buildings, a still greater saving is shown.

It is rather a new development in the heating field to control the temperature in an office building or hotel of large size, by means of a single thermostat located at an average-temperature point. While, of course, in this method of control, accurate temperature regulation is not possible, ample heat may be supplied and excess heating prevented, resulting in a very material saving.

In the accompanying article comparative data are presented showing the cubic feet of space, amount of radiation and estimated steam consumption figured by the engineer of the power company serving a number of buildings in Portland, Oregon, and the actual steam consumption under hand control and under automatic control. In almost every case automatic control showed a large saving. In one building with 8775 sq. ft. of direct radiation, the saving over a 6-month period was 778,000 lbs. of condensation. This amounted to an annual saving of $778.00 with a temperature-control installation costing approximately $250.00.

COMPARISONS MADE ON BASIS OF NORMAL TEMPERATURES

Some of these installations were made during the past year and show variations in temperature. We can only make comparisons on the basis of normal temperature which, of course, is not accurate. This, however, is taken as a basis upon which to work. In these comparisons, it is difficult to arrive at definite and exact figures or an exact average of saving that can be counted upon, owing to the tendency of various building superintendents to over-heat buildings, and to antiquated heating systems, modulating valves, air-bound radiators, etc.

An example of this is a hotel job with seventy-six rooms, a cubical contents of 267,000 cu. ft. and a radiation of 2,164 sq. ft. Actual records had been kept by the engineer of the number of hours the valve had been opened and closed and daily meter reading of the steam consumption. Average heating service given over a period of years before the automatic control was installed was about five hours out of a sixteen-hour heating day. With the installation of thermostatic control, full sixteen-hour service was given, with an increase in consumption of only 138,000 lbs. on a total consumption of 1,668,000 lbs. On this job it was also found that the store buildings in the hotel were not on separate meters and had been fully heated all day Sunday and during the night. Another unusual condition was found in an eleven-story office building with 613,000 cu. ft. contents and 6,137 sq. ft. of direct radiation. While automatic control showed a saving of 152,000 lbs., it was found that this building took longer to heat in the morning by automatic control than by hand control. Investigation developed the fact that the basement which previously had been used as a restaurant was used by a florist for a store room for cut flowers and plants. The heat would be turned off and the flowers watered two or three times a day and the evaporation caused an unusually cool basement. Also, the elevator acted as a suction pump while operating. It drew cool air from the basement and distributed it over the upper floors and on coming down the elevator, of course, forced warm air into the basement. This proved to be the cause of the excessive length of time required to heat the building in the morning.

As might be expected, the savings were more pronounced during the mild months.

TYPICAL EXAMPLE OF STEAM SAVINGS IN 16 LARGE BUILDINGS WITH TEMPERATURE CONTROL

	DURATION OF TEST, MONTHS	ESTIMATED CONSUMPTION, LBS.	CONSUMPTION WITH HAND CONTROL, LBS.	CONSUMPTION WITH AUTOMATIC CONTROL, LBS.	DIFFERENCE BETWEEN ESTIMATED CONSUMPTION AND ACTUAL CONSUMPTION WITH HAND CONTROL, LBS. LOSS	DIFFERENCE BETWEEN ESTIMATED CONSUMPTION AND ACTUAL CONSUMPTION WITH AUTOMATIC CONTROL, LBS. LOSS	DIFFERENCE BETWEEN CONSUMPTION WITH HAND AND AUTOMATIC CONTROL, LBS. LOSS	CONTENTS, CU. FT.	DIRECT RADIATION, SQ. FT.
BRALEY, GRAHAM & CHILDS	7	565,000	632,000	530,000	67,000	35,000	102,000	465,000	2156
BROADWAY BUILDING	9	3,120,000	3,326,000	3,174,000	206,000	54,000	152,000	613,000	6137
J.C. BOYER BUILDING	9	850,000		796,000		54,000		196,000	1824
COLUMBIA BUILDING	6		206,000	174,000			32,000		
COOK AND GILL BUILDINGS	7	630,000		548,000		72,000		140,000	1106
CARLTON HOTEL	14	5,425,000	4,646,000	4,562,000	779,000	863,000	84,000	527,000	6443
CORNELIUS HOTEL	7	2,430,000	2,434,000	2,277,000	4000	153,000	157,000	302,000	3299
FULOP BROTHERS	12	115,000	258,000	170,000	143,000	55,000	88,000	55,000	224
FITZPATRICK BUILDING	8	1,405,000		1,781,000		376,000		360,000	3261
MANCHESTER BUILDING	14	855,000	1,038,000	982,000	183,000	127,000	56,000	334,000	2283
MOOSE TEMPLE	12	1,505,000	1,717,000	1,574,000	212,000	69,000	143,000	308,000	1860
MORRIS BROTHERS	15	675,000	698,000	680,000	23,000	5,000	18,000	154,000	700
MAYLOR BUILDING	12	1,120,000		1,075,000		45,000		216,000	1735
RAILROAD EXCHANGE BLDG.	6	4,190,000	4,149,000	3,371,000	41,000	819,000	778,000	1,200,000	8775
SWEET SIXTEEN SHOP	7	335,000	372,000	354,000	37,000	19,000	18,000	165,000	535
SOVEREIGN HOTEL	3	1,600,000		1,176,000		424,000		510,000	6500

Fig. 1—Data for Buildings in Portland, Oregon.

The peak months in consumption of steam are December, January, and February, and show less saving by thermostatic control than do September, October, November, March and April. This is due to the fact that during the peak months the heating system is taxed to its full capacity and the valve remains open a greater part of the time. The length of time the valve is closed is very short and the gain obtained thereby is lost by reheating the system. If, however, the building has sufficient reserve radiation, a saving will be shown, but not in proportion to the other four or five months. During the remainder of the year the greater saving is made at the time the heating system is not taxed to capacity, when over-heating is possible.

The usual specification called for by heating engineers in Portland Oregon, is from 10° F. outside to 70° inside, but is found to be more like 25° outside, the heating plant bringing the temperature to 70° inside. Where the radiation of the building is properly figured, with reserves, a greater saving is found. The usual causes of loss by thermostatic control is that no reserve has been allowed in the system, or that the building partitions and rooms have been rearranged, alterations made, and no changes made in adding proper radiation to take care of those alterations. This causes considerable trouble in placing the thermostat in the proper location, but can be overcome by taking thermometer readings for a week or so from each floor, selecting the rooms most desirable for location of thermostat, and thereby getting the mean temperature of the various floors and the building. This, however, is exceptional in modern buildings, but care should be used in hotels and rooming houses where the thermostat is placed in a private room.

From charts it is found that it takes from two to two and a half hours to heat a building 50 ft. by 100 ft., five or six stories high, and that the valve opens and closes for a period of eight hours from four to six times a day in moderate weather.

PROPER LOCATION OF THERMOSTAT

In placing the thermostat, it is generally found that by selecting a large outside room facing east on the first, second or even third floor of a five or six-story building good results are obtained. The reason for placing the thermostat in an east room is on account of the extreme cold east wind (in Portland) during the peak months. This wind, of course, varies in different parts of the country, but should always be taken into consideration. The thermostat is placed in the largest room of an office building. When this room is heated, usually the rest of the building is comfortable. In hotels the best results have been obtained by placing the thermostat in the lobby and setting the indicator accordingly. Usually about 72° in the lobby brings from 68° to 70° in various rooms. Care should be taken to try and place the thermostat facing any outside openings, on account of the screen of the thermostat serving as a protection against outside draft from windows or doors.

Consideration should be given as to whether the building is heated by overhead feed, or from floor to floor. If overhead feed is used, best results are obtained on either the ground or second floor. If the other system is used it is better to place the thermostat on the top floor or the one next to the top.

LOCATION OF MOTOR

Place the motor as close to the valve as possible. Where the ceilings are low, it is necessary to place the motor at least 2 ft. below ceilings, to give the chain sufficient swing and eliminate friction and leverage.

Motors should always be counterbalanced where connected to valves 2½ in. or over. This is of great importance, as it relieves excess strain on motor and motor bearings and makes uniform strain both in opening and closing the valve. Care should be taken to have the pulleys far enough apart so that counterbalance weight will not foul or twist. The valve should equal the counterbalance weight and motor should turn over with-

out too much labor, both in opening and closing. When this is properly done 6-in. valves can be raised without trouble or undue wear on motor. Sash weights are very good for counterbalances, as they can be procured in almost any weight.

QUICK-OPENING VALVES GIVE BEST RESULTS

Best results have been obtained by using a quick opening elevating type of valve. This valve should not stick, chatter, or wire-draw if the weight is properly adjusted. The valve stem when heated should not distort or expand so that the seat will not meet properly, allowing leakage. The chain from the motor should be properly attached on the valve arm giving sufficient leverage to open the valve and allow the passage of steam. In some

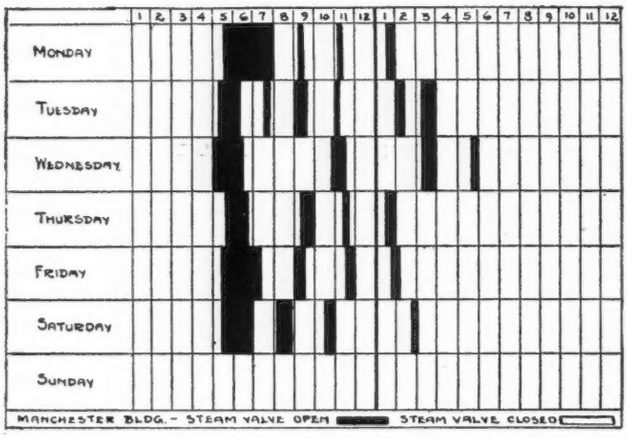

1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY
MANCHESTER BLDG. - STEAM VALVE OPEN
STEAM VALVE CLOSED

Fig. 2—Operating Data for Manchester Building.

cases it is necessary to put an extension on the valve arm counterbalancing accordingly to relieve the strain. Connecting the motor directly to the reducing valve is not successful because the construction of the reducing valve makes it necessary to add considerably to the weights on the valve arm in order to hold it open and avoid whipping of the arm from irregular steam pressure. In the present connection a quick-opening valve, in combination with a reducing valve, gives best results. By placing the quick-opening valve next to the shut-off valve before the reducing valve, back pressure is eliminated when the control valve is open or shut off. If the reducing valve is placed before the control valve sometimes the closing of the control valve causes the arm of the reducing valve to oscillate rapidly and throw the weights off the arm.

ARRANGEMENT FOR SWITCHING CONTROL

In some cases where the manager of the hotel lives in the building and it is found that his room is the logical location for the thermostat good results are obtained by installing a switch in the lobby, near the clerk's desk, connecting directly between thermostat and motor. This switch to be used for the purpose of turning on the steam upon arrival of guests in case thermostat had automatically shut off. This allows control from two places with one thermostat, and overcomes the only objections that might arise regarding thermostatic control in hotels.

LOCKS FOR THERMOSTATS

Sometimes where thermostats are placed in open rooms trouble has been experienced due to employees throwing the indicator over to 75° or 80°. This can be overcome by placing locks on the thermostat so the indicator cannot be raised above the steam point and the entire thermostat can be inclosed in a special casing that can be locked.

All large buildings not equipped with automatic heat regulators must and do rely entirely upon an engineer or janitor for the control of the steam valve. The hardest problem therefore is the proper instruction of the engineer so that he will take enough interest in his steam system to keep the consumption at a minimum. Usually they don't care and will follow the line of least resistance, not worrying about the temperature of the building or the steam consumption, generally overheating to be on the safe side.

In a good many cases, and this is especially true of large buildings, weekly, semi-weekly, daily or even twice daily meter readings are taken by the power companies in their effort to assist their customers in reducing their steam consumptions. Charts are made and kept, being turned over to the building superintendent or whoever is vitally interested in the steam consumption. This makes it possible to determine at intervals the consumption for any given period. The neglect of the engineer, however, has not been eliminated.

Recording instruments are also used as a check or the engineer is paid a bonus in proporation to the economy which he is able to effect. Ordinarily the other extreme is gone to in order to hold his job or increase the bonus with insufficient heat.

One very important cause for high heating costs is failure to turn off the valve at night. This too is many times neglected even though the engineer be thoroughly schooled in its importance. Many building managers assume this duty themselves but they are not always there. The duty is then turned over to someone else and the other man sometimes forgets it.

The installation of the automatic heat regulators eliminates entirely all of the human element connected with the economical use of steam. The thermostat is set for a desired degree and when this temperature changes the regulator opens or closes the valve automatically shutting off the steam before it passes through the meter.

The thermostat being placed as it is in the upper part of the building, brings it under the observation of the building superintendent or interested person and places him alone in full and complete charge. The clock attachment on the thermostat insures a closed valve during the night automatically opening whenever desired in the morning.

The following condensed instructions as to proper methods for the burning of coke in house-heating equipment are given by the Bureau of Mines:

Carry a deep bed of fuel; one about 18 in. thick gives the best results.

Use very little draft after the fire is started, and keep it always under control. The success of even heating depends on careful draft regulation.

Do not stir the fuel bed; clean the fire in the morning.

Use sized coke; ½ to 2 in. for furnaces, boilers and stoves; ½ to 4 in. for open grates.

Do not allow ash to accumulate in the ash pit.

House Construction That Reduces Heating Costs

Present Weakness in the Framed Wall or Balloon-Frame Construction Which is Typical of Most American Residences

By James D. Hoffman
Professor of Practical Mechanics, Purdue University

IN BUILDING residences, four things should be kept in mind— the convenience of the occupants, the efficiency of the building, considering it as a physical plant, the artistic effect of the finished structure and the first cost. Of these, the average builder takes account of the convenience, the artistic effect and the first cost, but seldom considers efficiencies.

Structures, even as machines, have efficiencies. These relate to certain physical values, such as the durability of the materials, the quality of the workmanship, the annual expenditures for upkeep and the annual expenditure for heating, all of which are factors in the formula for efficiency. Of all these factors, the annual expenditure for heating is the one most frequently overlooked in connection with the character of the building itself. In new building projects, of course, heating systems are carefully considered, but always as one system compares with another system and not from the standpoint of how the (any) system of heating may be influenced by the type of building which surrounds it.

IMPROVEMENTS WOULD SAVE FUEL BILLS

The average house is bristling with hidden defects which, if attended to at the proper time, could be eliminated with small additional expense. Having in mind only those reasonable improvements which should be made in every case, the yearly fuel bills in the average house might be reduced, because of house construction alone, fully 25%. That is to say, whereas the soft coal fuel consumption in heating the average residence is now understood to be about one ton more than the total number of rooms and principal halls in the house, with a type of construction that is not only possible, but which should be expected in every case, this amount of fuel should be reduced to, at most, three-quarters of a ton for each room and principal hall in the house.

If our houses were built with insulated sides, like fireless cookers, we could make them comfortable throughout the average winter with the use of but a small amount of fuel. This construction would not be desirable from the standpoint of health, because we need fresh air, but our present practice is quite the opposite. Because of imperfect construction we are not able to close up the average house on a winter's night tightly enough so that it can be made comfortable at all. This is especially true when there is a high wind. As a consequence, most of the available heat passes through the walls, ceilings and floors to the outside air and is of little usefulness in maintaining warm room interiors.

A pound of soft coal (most residence fuel in this part of the country (Indiana) is soft coal), selected from various mines in the country, may contain anywhere from 10,000 to 14,500 heat units. Of this amount, when the coal is burned in the average heating system, at least 40% is lost through imperfect combustion, by radiation and by convection up the chimney. Much of this 40% loss cannot be avoided. The rest, say 60%, finds its way into the living interiors of the building. It is this 60% we are now especially concerned with.

THE FRAMED WALL

This may be the best type of insulated wall or the worst, depending upon the design and the care with which it is constructed. Fig. 1 shows a horizontal section of such a wall as it is usually laid out. It will be noticed that the studs are set 16 in. on centers with the outside and inside finish nailed directly upon them, leaving an inclosed air space, approximately 3¾ x 14¼ in. It is this air space which may be a friend or enemy,

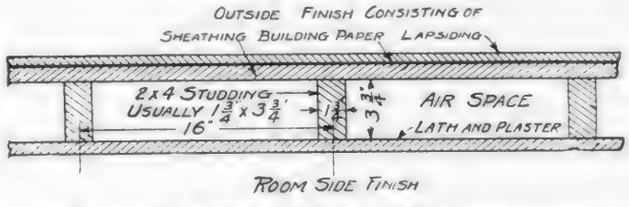


Fig. 1—Usual Type of Framed Wall Construction.

as we choose. The temperature of the room air is supposed to be maintained at 70° and the temperature of the air space is somewhere between this and that of the outside air. If the outside finish is tight, the space temperature is maintained more nearly to that of the inside air; on the contrary, if the outside finish is loose and open, the space temperature is low and there is more heat lost through the inner lath and plaster finish to this space.

The one-half inch of lath and plaster finish next the room is one of the serious weak points in this type of wall, as heat and air easily pass through it. As a convincing illustration that plaster is a very poor insulator, one has but to glance

A survey of the residence situation in any part of the country, comments Professor Hoffman, will show a large preponderance of the framed-wall type of housing; in fact, most American residences are so constructed. Because of the predominance of this type of house in the economy of the home life of the country, particular attention should be paid to its development along right lines. The accompanying suggestions, therefore, which are reproduced from a bulletin (No. 2) by Professor Hoffman, and published by the Engineering Extension Service of Purdue University, Lafayette, Ind., are intended to set forth some of the present weaknesses in the framed-wall type of construction and to indicate reasonable modifications which may be recommended as substitutes for present building practice.

at almost any second-floor plaster ceiling where the upper side of the joints are not covered in a tight floor. Such ceilings show parallel dark and light lines alternating with each other. The dark lines are the spaces between the laths that have become filled with the dust particles separated from the air in its passage through to the attic space. That part filled by the laths offers more restriction to air passage and shows lighter in color. Our present practice on interior wall finish leaves much room for improvement.

Some progress has been made in the development of a composition wall finish. One form has a paper base and a plaster face, the plaster being held to the paper by woven wire or other form of binder. Another form has a plaster center reënforced with wood fibre and both surfaces covered with heavy paper. Paper is a good insulator and is very effective in cutting off air transmission. It will seem, therefore, that some such solution may eventually be worked out and that an effective interior wall surfacing, at a price approximately that of the present type of construction, may become generally used.

GOOD EXAMPLE OF INTERIOR LATH AND PLASTER CONSTRUCTION

A modification of the present interior lath and plaster construction that can be highly recommended is shown in Fig. 2 (a) and (b). The first shows building paper nailed to the inner face of the studs, with enough slack between the studs to permit the plaster to clinch on the inside of the laths without tearing the paper. The laths are then put on in the usual way and the surface plastered. Care should be taken in so running the paper to

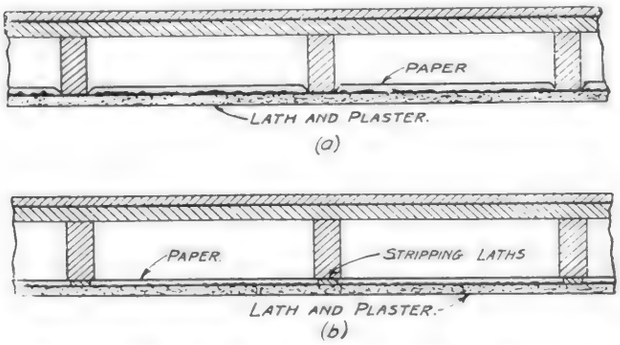


Fig. 2—Good Interior Lath and Plaster Construction.

see that it is satisfactorily lapped and that the slack is uniform on all overlapping edges. When laying the paper, the upper sheets should be put on first so as to permit the successive lower layers to overlap the ones above. This will retard the passage of air through the joints from the room to the stud space. Paper put on in this way will have a tendency to cut off air circulation and produce a dead air space between the paper and the plaster.

A most satisfactory way of laying the paper is to stretch it tightly over the studs and strip the inner face of the studs with laths. The laths for the plaster wall are then nailed to these stripping laths, as shown in (b) of the same figure. If this method is used, it will probably be necessary to build up the thickness of the window and door casings by the thickness of the stripping laths, on account of the increased thickness of the wall. When applied to a ceiling this objection does not hold. Either of these two schemes, if properly applied, will cause a marked saving in fuel.

A TYPE OF BAD STUD CONSTRUCTION

As there is considerable loss of heat from the room to the stud spaces, it becomes important to make these spaces as tight as possible to avoid the escape of heat to the outer air. Many buildings are constructed with the stud spaces opening directly into either the basement

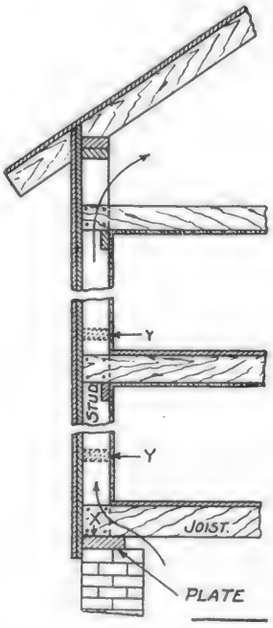


Fig. 3—Conditions Frequently Found in Old Buildings.

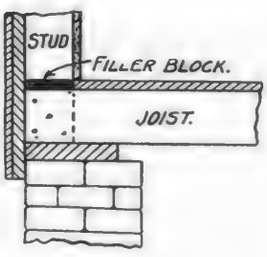
or the attic spaces, or into both, as shown in Fig. 3. Such construction is bad in the extreme. All stud spaces should be tightly closed at both basement and attic floor lines, otherwise these become circulating air spaces and act as chimneys to carry the heat to the attic.

Any good method of blocking off at these points may be recommended. In old buildings, where the studs extend to the plate, Fig. 3 at X, and the floor meets the inside edge of the studs, this space is probably open. The only way to correct this is to insert filter-blocks between the studs on a plane with the floor, as shown in Fig. 4. Where the house is new construction, a number of methods must be resorted to, the most satisfactory of which is to floor over the entire first floor area as far as the sheathing on all sides, Fig. 5, and set the studs upon plates laid broadside upon the top of this floor. This arrangement will effectually cut off all air communication between the basement and the stud spaces.

At the attic floor line, where the joints are laid upon the rafter plates, there is no difficulty because the inside finish of the upper rooms extends up to and includes the plates, Fig. 6, at A. On the other hand, in attics where head-room is at a premium, for storage purposes, the roof line is usually raised some distance above the floor line and the floor joints are supported upon ribbon boards let into the studs. In such cases the stud spaces are usually wide open to the attic, as shown in Fig. 3.

These may be closed as shown in Fig. 7. As far as the spaces are concerned, these can be effectually closed by stripping the under side of the joists behind the ribbon board, as at B, but a better way is to floor the attic tightly and fill in between the studs or sheaths the studs up to the plates, as at C. This cuts off not only the stud spaces but it reduces the heat losses through the upper ceilings to a minimum, as stated later in this discussion. If this sheathing is continued far enough to fill in between the rafters, it will keep out the dust and soot particles which otherwise enter at the eaves.

In addition to what has been said about closing the extreme ends of the stud spaces, it is highly desirable to break these up into smaller spaces by nailing-in stud-ends sawed to fit between the studs, as shown dotted in Fig. 3, at Y. Such blocks are called *fire-blocks* and not only improve the insulating qualities of the wall but they reduce the fire hazard and are recommended by



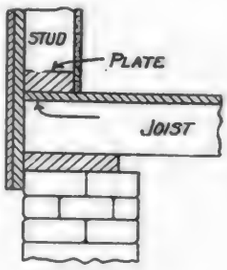


Fig. 4. **Fig. 5.**
Methods of Stopping Air Leakage in Stud Spaces.

fire insurance companies. Fire from the basement frequently breaks through the first floor and passes up between the first floor studs of an interior wall, then between the second floor joists to the outside wall. In such cases fire-blocks immediately above the level of the second floor are very effective in checking the fire.

OUTSIDE FINISH SHOULD BE INVESTIGATED

With the stud spaces effectually closed and sealed, next investigate the outside finish. The usual construction here is, one layer of 7/8-in. sheathing boards on the studs, one layer of building paper on the sheathing and lap-siding on the paper. This is a good arrangement, providing good materials are used and care is exercised in its construction. This finish should be not only a good heat insulator, but it should be tight against air leakage.

LAP-SIDING IS SELDOM TIGHT

Several critical points in this construction should be mentioned. Lap-siding, so generally used in this type of construction, is seldom tight. It therefore rests with the building paper and the sheathing to be the protecting elements. Fig. 8 is a type of construction that is very bad. The building paper here is omitted and the sheathing boards are butted on the edges. In this case the rooms on the windward side of the house could scarcely be comfortable, no matter what heating system was put in, because of the effect of wind leakage into the stud spaces. Building paper or equivalent should always be put on over the sheathing.

HOW TO PROVIDE FOR SHRINKAGE IN SHEATHING BOARDS

Sheathing boards should be straight and free from loose knots, and the edges of these boards should have either a tongue-and-groove or a half-lap joint. With such edging, shrinkage may take place without opening the joint for air passage. A butt joint may be comparatively tight when first put in, but will not remain so. After the boards have been nailed in place, shrinkage cracks of considerable size open up. A good layer of building paper may cover such cracks and cut off a large amount of air leakage, but there will still be a large heat loss because of the openings through the sheating.

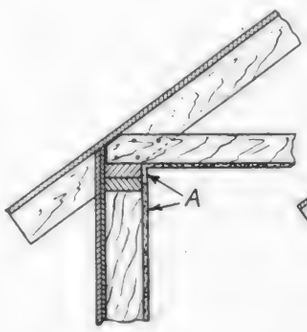
Figs. 9 and 10 show two joints recommended. From a practical standpoint, one is about as good as another. The ship-lap (Fig. 10) is somewhat cheaper in first cost and is easier to lay, consequently it is the most frequently used, but the style of the joint permits more freedom from warpage.

WORKMANSHIP A PRIME FACTOR

No less important a factor in the construction of a well-insulated wall is the workmanship. Having supplied first-class materials for the job, the owner has a right to expect first-class workmanship, but unfortunately this is not always the case. A careless workman will probably build a substantially strong wall, but the tightness of the wall and the elimination of cracks give him little concern. Many houses are erected on rush contracts for immediate sale, or by owners who are not informed as to what is good or bad practice, and in such cases defective work is quite common in concealed places. These defects cause unnecessary heat losses which, in extreme cases, may become as great as three times the loss expected from a well-constructed wall.

THE WINDOW PROBLEM

The window problem in the modern residence is an important one. The value of light room interiors is being increasingly recognized and more windows in out-



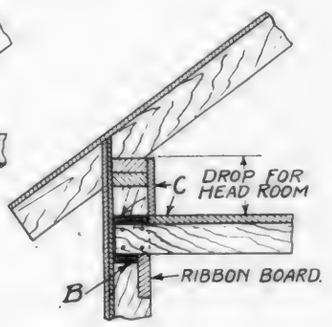


Fig 6. **Fig. 7.**
How to Stop Air Leakage in Attic Space.

side walls are demanded. Since the heat lost through 1 sq. ft. of glass window is about four times that through 1 sq. ft. of the average framed wall, the heat loss due to conductivity is something to be considered, even though no mention is made of the tightness of the fit in the casement. Add to this loss the heat loss due to air leakage and the problem becomes increasingly important.

Buildings are subjected to air inleakage through the walls, floors and ceilings, and around the windows and doors. Of these, that through the opening around the windows and doors is probably the least considered. Because of the large number of windows in the modern residence, those fitted loosely in the casings (this includes a large majority) become a very important factor in the heating economy of the building. Considerable experimentation has been carried on to determine just how much the heating of the building is affected by loose windows, but as yet the results obtained are open to so much guesswork that it is not safe to give anything but the most approximate estimates. The following conclusions have been arrived at by H. G. Whitten after a long series of experiments, and these may be taken as a fair statement of the case:

1. Average wind velocity in localities where heating is important, 13 miles per hour.
2. Average sash clearance, 1/16 in.
3. Air pressure equal to a 15-mile wind, against a window having a 1/16 in. clearance, will force 146 to 185 cu. ft. of air through each lineal foot of window clearance per hour.
4. Insulated windows, metal weather strips, etc., reduce the leakage as low as 1/5 to 1/9 of that found in the average window.

When it is realized that many windows have larger clearances than 1/16-in. and that it takes much good heat

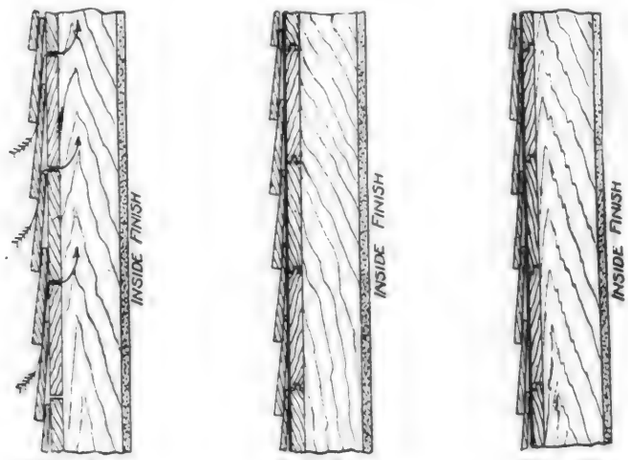


Fig. 8. Fig. 9. Fig. 10.

Bad and Good Types of Lap-Siding.

from the coal to raise the temperature of this inleakage from zero outside to 70° inside, the importance of the loose window problem will be better appreciated.

As an illustration of what is happening in very many homes of the country on any zero day, assume the following: A living room 13 x 15 x 10 ft., with a total window perimeter of 50 ft., a crack of 1/16-in. around each window and a 15-mile wind striking the windows. Using the lower value previously quoted, 146, there will be 7,300 cu. ft. of outside air entering the room per hour around the windows. That is to say, 3.75 room volumes of air must be heated from zero to 70° every hour at an expenditure of 9,290 B.T.U. With soft coal at $10.00 per ton and 12,000 B.T.U. per pound, and with 60% of this credited to the house, there will be an expenditure of 15.5 cents per zero day of 24 hours solely for heating the window inleakage in this one room. Some of this expenditure should not be charged up as loss, because no matter how hard constructors exert themselves to make a well-insulated job, there will still be some inleakage. It is also desirable that a certain amount of outside air enter the houses to insure healthful room conditions. Ventilation, however, may be accomplished in a better way by the opening of windows or through specially-prepared ventilating ducts.

To prove the effectiveness of any heating system, it should be tested on a windy day.

ATTICS SHOULD BE FLOORED

Most of the attics in residences are not floored. This is a serious mistake, even though the attic is not used for living or storage purposes. Heat losses are continuous throughout the heating season of eight months and at no place within the house is this loss more noticeable than through the upper ceiling. For the purpose of illustration, suppose the average house has an attic floor area, exclusive of that covering closets, of 600 sq. ft. Will it be an economy to floor this attic?

Cost of flooring attic: Allowing 75 sq. ft. of floor surface for closets, 675 sq. ft. of floor area may be covered tightly with 6-in. No. 2 flooring at the present price of lumber, for $48.45 ($36.45 lumber, $12.00 laying). This is a first cost expense and will not be duplicated. There is, however, a loss of interest to the owner on that amount of money at 6%, amounting to $2.00 per year.

Attic Not Floored: In the average framed house, when the outside temperature is zero, the temperature within the attic may be expected to be 25° to 30° above zero. With the normal room temperature 70°, the heat loss through one square foot of plaster ceiling under such conditions will probably approximate 40 B.T.U. per hour. For 600 sq. ft. this will be 40 x 24 x 600 equals 576,000 B.T.U. per day. The average heating day in this locality for the heating season is about 44% as severe as a zero day, hence for an average day the heat loss to the attic from these second floor rooms will be about 253,440 B. T. U., and for the average heating year of 240 days the loss will be 60,825,600 B. T. U.

Attic Floored: If this same house were floored, as stated above, the heat loss through the ceiling and floor would be about 40% of that just figured for the ceiling alone, consequently, the heat saved in one year by flooring the attic is, 60 x 60,825,600 equals 36,495,360 B.T.U. With a grade of soft coal averaging 12,000 B.T.U. per pound and 60% of this credited to the house, this would amount to 2.53 tons of coal in the bin, and with this coal selling at $10.00 per ton, would mean a financial outlay per year of $25.30. At this rate the coal saving would pay for the floor and the interest on the money invested in the floor, in approximately two years.

Fuel saving, as mentioned above, however, is not all there is to the problem. The extra heat lost from the rooms through the ceiling would necessitate the installation of 600 x 40 x.60 ÷ 250 equals 58 sq. ft. of steam radiation. This, with its proportional share of pipes and fittings, would cost at least $43.00, which in itself almost pays for the floor. If a water heating system is installed, the extra cost will be about $65.00. If a furnace system of heating is used, the amount of additional cost would

not be so striking, but it is safe to say that it would be worth considering.

CHIMNEYS

A source of annoyance and waste in the operation of small residence plants is the unsatisfactory operation of the heating plants, due to unsuitable chimneys. In chimney operation, height produces draft and net cross-sectional area gives capacity. That is to say, the higher the chimney, the greater the "pull" on the chimney gases and the less the danger of smoking at the furnace. Also, the larger the net area of the chimney, the more coal may be burned in a given time without choking the chimney enough to kill the draft. These two factors, height and area, are inter-dependent and each should be considered with the other. In this connection some general facts should be observed.

CHIMNEY HEIGHT

The least height of a chimney for residences is variously stated from 30 ft. to 35 ft. Chimneys less than 30 ft. high are likely to be erratic in their action. The furnace codes approved by the various engineering societies interested in furnace heating give as a least value 26 ft. above the furnace grate, which, to say the least, should be considered a minimum in all cases.

CROSS-SECTIONAL AREA

In the average residence the cross-sectional area more frequently causes trouble than the height. The ideal section for any air duct is a round one. This does not work in very well with the brickwork, however, and a square section should be approached as nearly as possible, keeping in mind that whatever shape is adopted, it must fit the usual sizes of bricks. In many chimneys already built, the section is a long, narrow one, the least dimension being the width of one brick (4½ in.). This is entirely too small to give good service. Because of the mortar burr projecting from the joints between the brick, this dimension is frequently as small as 4 in. There is a dead zone next to every frictional surface (that next to an ordinary brick wall is extravagantly large) which is ineffective as free area. The gases moving along such a surface do not slide but roll and tumble, thus farther restricting the free passage up the chimney. In a chimney as stated, having a thin rough flue, this neutral zone may be sufficient to practically nullify the entire draft area.

One prominent authority states that this zone extends a distance of 2 in. or more from each brick surface toward the center of the chimney. From a practical standpoint, therefore, a nominal 4-in. by 12-in. standard chimney flue is very much less effective than an 8-in. by 6-in. flue, if such could be constructed. In practice, no chimney flue should be made of less internal area than an 8-in. round or an 8-in. by 8-in., and in moderate sized houses the working conditions of the chimney are improved if this is enlarged to an 8-in. by 12-in.

CHIMNEY LINING

All chimneys should be lined with the best hard-burned flue-tile lining throughout the entire length of the chimney, the tile to be not less than ¾-in. thickness. This is especially necessary if the chimney is built of a single thickness of brickwork or of a cement block construction. There are two reasons for this. The smooth interior of the tiles eliminates a large amount of the friction usually found between the moving column of gases and the inner surface of the brickwork, and, in addition, tiles are a safeguard against fire, since they cover up any open joints or cracks often occurring in the average mortar joint in one-brick walls.

An examination of many attic chimneys will reveal such cracks. They are easily distinguished by a feather of black soot and dust around the opening. In normal operation, the draft within the chimney is sufficient to cause the surrounding air (say attic air, because most of the roof fires begin in the attic), to pull inward toward the chimney. When a heavy deposit of soot collects upon the inner surface of the chimney and this is fired by an extra hot fire in the furnace, the gases trying to escape from the top of the chimney are so great that the "pull" of the chimney is overcome and a reverse condition takes place. The pressure within the chimney now is greater than that of the air without and the hot gases are forced out through the cracks to the attic, igniting any combustible material in their path. Many of our mysterous roof blazes could probably be traced to this one defect in chimney construction. Tile linings effectually cut off gas leakages to the house, but emphasis should be laid upon the fact that the lining should be of the best and strongest quality, each section end should be well bedded in a good mortar joint, and the entire lining should be laid against the brickwork but should not be slushed in. This will permit the lining to expand and contract free from the chimney proper, thus avoiding the cracking and crumbling of the lining.

INTERIOR VS. EXTERIOR CHIMNEYS

Connection of air or gases (their tendency to rise and mix) is due primarily to heat. Any body of gas upon being heated expands and becomes lighter. Since all gases are, comparatively speaking, perfectly fluid, the lighter (warmer) volumes rise and the cooler and heavier volumes fall, an interchange due to gravity. It can easily be seen, therefore, that a protected chimney that keeps the gases from losing their heat as they pass up the chimney will produce a better draft than one which is not well protected and permits the gases to lose their heat. That is to say, an interior chimney (one running up through the house, inside the outside walls) will give more uniform draft than one built up as a part of the outside wall.

In recommending the use of inside chimneys for best furnace service, the writer is not unmindful of the fact that the outside chimney has become very firmly established as an architectural feature in the home. There is no desire to change this attitude. The outside chimney lends itself not only to outside, but to inside, decorative effect and may be used whenever desired, with proper restrictions. First, if a consistent draft is demanded for all weather conditions, the chimney should be double-walled on the outside, at least as far up as the eaves; second, if the heating furnace is to be attached to this

chimney flue, it should be done with a full knowledge that the draft may be bad just on those days when the best draft is desired. It should also be remembered that heat radiated by an inside chimney goes to heat the house but that from an outside chimney is a total loss.

Other points to be considered in chimney construction may be stated very briefly.

All chimneys should extend to the basement floor and should rest upon suitable foundations to prevent settling and cracking.

All furnace chimney flues should begin near the basement floor and should have convenient clean-outs at the lowest point.

No smoke connection should enter the chimney flue other than the furnace pipe.

All chimneys should extend two to three feet above the highest point of the roof. Those that are overshadowed by a nearby building may require a "cowl" to avoid downdraft when the wind blows over that building.

No woodwork of the building should be rigidly fixed to the chimney. This is frequently done and is the source of much annoyance in the raising and lowering of floors, doors, etc., as the expansion and contraction of the chimney takes place. In the winter when the house is at its least size, the chimney has expanded to its greatest length, and in summer the reverse conditions prevail. This requires the frequent trimming at top and bottom of all partition doors near the chimney to avoid binding, a condition which would not exist if the chimney were at liberty to expand and contract free from any house restrictions.

Discussion By J. M. Robb

If the loss and damage caused by buildings that leak heat too freely were as visible as the loss and damage a leaky roof makes, there would be in actual operating existence today a class of builders as extensive as roofers, fully prepared to protect every class of building against preventable heat losses.

To show what can be accomplished in this respect, consider a group of buildings in Minnesota where the temperature often reaches 30° below zero. It is the practice in this group of buildings to shut steam off from them from about 10 a. m. to 4 p. m., regardless of outside temperature.

It is surprising how slowly the inside temperatures fall. They do fall, of course, so that at about 4 p. m. heat is again turned on for a period up to about 9 p. m., when it is again shut off until about 4 o'clock the next morning. Let those who are curious to know what sort of building construction this practice indicates try it on their own structures on a zero day and note results. In this particular group some of the buildings have storm sash. Others, two modern ones, are equipped with metal weather strips.

It seems that the metal-weather-stripped buildings lose heat more slowly than those equipped with storm sash. So it is assumed that metal weather strips, properly applied, are superior to storm sash for saving heat. A proper combination of both would probably be more effective.

Heat is lost from buildings by radiation through walls, through glass and through floors resting on earth, and through roofs. But most of all, heat is lost from buildings by reason of air leakage. The air that leaks out at the indoor temperature must be replaced by air brought in from out-of-doors and warmed to room temperature. This is the greatest item of preventable loss. It usually wastes far more fuel than the operation of a most liberally-designed ventilating plant would require.

At this point someone is almost sure to say we want air flow through our buildings for ventilation. We also want water flow through our buildings for sanitary purposes. But we do not permit it to come through leaky roofs. We bring it in through proper channels so that we can control it.

Anything, therefore, that will stop air leakage from our structures will prevent the most heat loss. Air leaks may be enumerated as follows:

1. Around the window sash.
2. Around the window frame.
3. Around the doors.
4. Through upper floor ceilings and roofs.
5. Through the walls.
6. Through flues and other provisions for ventilation.

To stop air leaks, therefore:

1. Windows must be equipped with metal weather strips.

2. Window frames must be caulked.

3. Doors must be weather-stripped, door frames caulked, and vestibules or revolving doors provided.

4. Top floor ceilings must be made proof against air flow through them and attics and roof spaces must be made air tight. Whenever the requirements in this respect are appreciated, the practice of providing air flow over top-floor ceilings and under the roof to prevent summer overheating will be stopped. The proof of adequate protection in this respect lies in the amount of temperature rise on the top floor of a structure on a hot day. If the top floor ceiling is adequately proofed against winter heat losses, there will be no rise in temperature on top floors with no air flow over ceilings.

5. Walls will be lined with sheathing quilt to seal them tightly against air flow.

The usual brick wall sometimes leaks air so badly that paper or burlap applied inside for decorative purposes has been known to be blown off by high winds on the outside walls.

The usual hollow tile lining of an outside brick wall is not the protection against heat loss it is usually assumed to be. Instances are plentiful, in testing chimneys for tightness, where every window frame on the chimney side of the building leaked smoke. This was due to lateral travel from a poorly-constructed chimney. But it has happened so frequently as to warrant the belief that the usual hollow tile wall leaks more air than a solid one.

TROUBLES WITH FROZEN RETURN RISERS

So much trouble has been experienced from leaky walls on tall buildings resulting in frozen return risers, even with the heat on, that some of our leading heating contractors prefer one-pipe steam work for this class of building. Condensation in contact with the steam never freezes. Adequate protection of walls by quilting or otherwise, making them airtight, would make it safe to use the more efficient two-pipe work.

VALUE OF AIR SPACES DEPENDS ON ARRANGEMENT

There is no little misunderstanding of the value of air spaces in walls and other building construction to prevent excessive heat losses. The usual effect of most hollow walls, air spaces, hollow tile, cement block and similar construction is to increase air leakage through the walls. We know enough about heat insulation now to realize that it is the air held in a material in minute particles that prevents heat losses. Therefore, if our hollow walls, hollow tile, cement blocks or similar construction were filled with sand or some similar material that would hold air in minutely-subdivided particles that would make air motion impossible, they would be improved. Engineers who have contended with air leakage through hollow wall boiler settings appreciate this better than most people.

USE OF MINERAL WOOL OR SIMILAR MATERIAL ADVOCATED

In frame houses, or framed structures, brick veneered, the best construction would fill the space between vertical studs solidly with mineral wool or some similar material. Or else the space between the studs would be filled with conder concrete, or the like.

Particular attention would be given to stopping off all vertical wall spaces at every floor and ceiling, and particularly in the attic construction. Especial attention is required to seal with an air-tight construction all outside walls at porches and roofs.

Top-floor ceilings also require attention. Some architects and builders make it their practice to build full concrete slabs over the top floor ceiling in the roof space as if there were no roof. This reduces attic space to almost the same temperature as the outside air. With only lath and plaster between the rooms beneath and the outside, it is little wonder that some upper floors of structures produce constant complaints of lack of heat in cold weather.

Whenever we meter our heat input to our buildings for warming them with the same accuracy that power input for a given refrigeration effect is measured, we will build for the same resistance to heat losses in every building to be warmed that we now build in every structure to be refrigerated. Also, if every structure could be subjected to a smoke test before it is accepted, just as a chimney is tested for tightness, few of them even would be accepted under present building practice.

PRACTICE FOLLOWED IN CONSTRUCTION OF ST. LOUIS SCHOOLS

To show what can be accomplished in this respect, consider the present practice in building St. Louis public schools. There is such a rare degree of co-operation between architect and engineers in designing and erecting these buildings that St. Louis can both heat and ventilate its school buildings with all blast systems. In an all-blast system, of course, the same air that ventilates also carries all the heat required, so that no direct radiation is used.

In St. Louis metal weather strips are applied to all windows. The south and east windows are as well protected as the north and west windows. All window frames are caulked with an elastic cement that is permanently proof against shrinkage. In the most recent buildings a full concrete slab is provided over the top floor and the roof space is made as nearly air-tight as possible.

There are few buildings erected anywhere with so much attention paid to insulation against preventable heat losses as in St. Louis. The result is shown by tests to measure the air leakage. In these buildings the fans recirculate the air, freshening it with ozone. The vent flues are connected into a trunk direct in the roof space. This duct, in turn, is connected to the fan inlet through heaters, air scrubbers and ozone generator. There is also a fresh-air inlet provided. In a recently-completed building the fresh-air inlet was left wide open last winter and air flow through it measured. The tests showed that only 10% of the air delivered by this fan entered from the fresh air inlet, and this included what the toilet exhaust fans positively removed from the building. There are few buildings anywhere that could make an equal showing. Some of the older buildings, where less care had been taken to prevent air leakage, showed, according to tests, that the fans were taking approximately 30% of outside air.

The practice of applying metal weather strips only to the north and west windows, as is sometimes done, is a benefit, but it is only a half-way job All windows should have metal weather strips, properly applied.

The reason storm sash are not as effective as metal weather strips lies in the air leaks around the storm ash. These air leaks increase with every removal and replacing of the storm sash. Also, while a square foot of window glass area does lose approximately four times the heat that a square foot of outside wall loses, this loss is but a small percentage of that caused by air leakage. So that if the air leaks can be stopped, the radiation losses from the single glass will be found of little consequence.

Points on the Selection of Steam Pressure Reducing Valves

By W. F. Schaphorst

Where all low-pressure steam for heating and similar purposes does not come from one or more bleeder turbines or from the exhaust of non-condensing turbines or engines, and where some of the steam or the major portion of it must come from high-pressure or medium-pressure steam, it is common and good engineering practice to use high-grade reducing valves for reducing the pressure down to the required pressure.

Although steam-reducing valves are very commonly used in nearly every industrial plant where steam is used for heating, and although reducing valves are an important economy factor as regards first cost of valves, pipe and pipe connections, up-keep cost, dependability, and perfection of performance, yet it is a fact that very little has been written or printed about the real service of reducing valves and how they should be selected. This lack of attention to reducing valves is probably due to the belief by most engineers and officials that "all reducing valves are alike, that one valve is as economical as another, and that nothing is to be gained by giving the

matter careful consideration because of its relatively small importance when compared with the larger apparatus in the power plant."

Such reasoning, however, is unsound. The big and really important things are made up of a great many little things. To simply install an efficient steam turbine and boiler, for example, is not enough. Efficient large apparatus is commendable to be sure, but one should not rest there. The hundreds of "little losses," added together, usually amount to more than the savings that can possibly be brought about by the most efficient turbine and boiler combination obtainable. The reducing valve, therefore, should by all means be taken seriously.

The types of steam-reducing valves from which the engineer may make his selection are few in number. This may not sound true, but it is a fact that there are only two types of reducing valves on the market that vary in principle.

The first, which was the original type and has changed but little since the days of Watt, is the diaphragm or piston type. This type is by far the simplest of the two, for it consists of only two moving parts, the diaphragm or piston, which is affected by the pressure to be controlled, and the valve, which restricts or cuts off the flow of steam from the initial pressure side to the reduced pressure side of the valve.

The valve which employs a diaphragm for its operation is best suited for low pressures, as the diaphragm area can be made very large, compared to the size of the valve, without materially increasing its cost. On account of the large area of this diaphragm, the valve will respond to the slightest change in pressure.

Diaphragms are usually made of rubber or phosphor bronze. The rubber diaphragm has the advantage of greater flexibility, which permits a greater travel of the stem. Where protected by a water-leg so that the steam does not come in direct contact with the rubber, such a diaphragm will give good service for a number of years. The phosphor bronze diaphragm is limited in flexibility, but has an advantage over rubber in not being so easily affected by the heat.

Valves that employ a piston for their operation cost less to make and consequently can be sold at a lower price. They are best adapted for service above 5 lbs. where there is always some circulation through the valve.

The type of valve that is used in the diaphragm or piston-controlled valve, is either the double-bevelled disc type or the sliding-piston type. The double-bevelled disc type has the advantage of being tighter than the sliding-piston type, with the disadvantage of being affected by variations in the initial pressure on account of the seats being out of balance—as one disc must always be of greater diameter than the other. Neither the double-disc nor the sliding-piston type of valve can be made tight enough for what is termed dead-end service, that is, where the valve discharges into a dead end, so that the slightest leak through the valve will result in the pressure on the reduced pressure side equalling the initial pressure.

Both the diaphragm and the piston-operated types of valves are adjusted by means of a weighted lever or an adjustable spring for low-pressure or vacuum heating work. The weighted lever is the method used mostly, but for higher pressures, on account of the number of adjusting weights required, the adjusting spring has the advantage of using less space and places considerably less strain on the valves and connections.

As the demand for steam at higher pressures increased, and as the requirements became more exacting, it was found that the old type of reducing valve would not do, thus a natural demand was created for a different type of valve. This resulted in the auxiliary-operated type, that is, a valve with an auxiliary or "pilot valve," which, by means of a piston, operates the main valve.

The mechanism which controls the valve, usually a spring-loaded diaphragm, must only handle by means of the pilot valve sufficient steam to operate the piston which in turn controls the main valve. As this volume of steam is very small, the slightest decrease in the controlled pressure is sufficient to move the diaphragms enough to supply full pressure to the valve piston, which causes the main valve to open wide, and the slightest increase shuts off the pressure to the piston, which permits the main valve to close tight.

The advantages of the auxiliary-operated valve over the old type are many. Probably the most important is that this valve will shut off tight on the slightest change in the reduced pressure, making it the only valve suitable for delicate or dead-end service. Any reduction in pressure can be accomplished through a single stage, which is an important advantage. It is also worth while knowing that this valve always remains sensitive under high-pressure service.

The important factor to be considered when selecting reducing valves is the nature of the service, having in mind the following facts:

Diaphragm or piston-controlled valves are not suited for dead-end service, nor where a great reduction in pressure is desired through a single stage.

Diaphragm or piston-controlled valves, with weighted levers, are not suited for high-reduced pressure service.

Valve seats of the sliding-piston type are suitable only where there is no objection to a constant flow of steam of considerable volume.

Auxiliary-operated valves are suitable only where the initial pressure exceeds the reduced pressure by at least 10 lbs.

Cast-iron or bronze-body valves are not suitable for temperatures exceeding 450° F.

As the life of a reducing valve is considerably less than the life of pipe fittings and of the ordinary globe valve, it is an advantage to have union or flange connections on all reducing valves so that repairs can be easily and quickly made without disturbing the balance of the pipe line. If possible, select a valve that can be repaired, without the necessity of removal from the pipe line.

NOTE: It might be added that two classifications of reducing valves have become pretty generally recognized. The first is for low-pressure heating work and the second is for general industrial service. For heating work, where boiler pressures are not apt to exceed 125 lbs., the diaphragm-operated type of valve, either spring or lever and weight resisted, has become pretty generally recognized as standard. For industrial work, where higher boiler pressures are encountered and where a wide range of adjustment for the delivery of presure may be necessary, the secondary-operated valve is very generally used.

Aerology for Amateurs and Others

The Evolution of Modern Ventilation and its Effect on Present and Future Practice

By E. Vernon Hill

Previous articles in this series are as follows: January, 1923, Historical Sketch; February, 1923, Health and Comfort Factors; March, 1923, The Manufacture and Use of Thermometers; April, 1923, Test Methods; May, 1923, Air Dust.

VI—Classification of Test Methods for Dust Determination

IN AN article entitled "Quantitative Determination of Air Dust," appearing in THE HEATING AND VENTILATING MAGAZINE for June, 1917, the writer classified methods of dust determinations under the five headings of:

1. Visual comparisons.
2. Weighing methods.
3. Condensation Methods.
4. Diffraction methods.
5. Counting methods.

This classification still holds good, with the addition of a sixth method recently developed in the Research Laboratory of the American Society of Heating and Ventilating Engineers. The apparatus referred to is the invention of Otto W. Armspach and is known as the Anderson-Armspach dust determinator. A brief review of these methods may be of interest.

1. Visual Comparisons

Under this classification come the more or less primitive methods of collecting dust on cheesecloth screens, white porcelain plates smeared with colorless adhesives, etc., and making a visual comparison of the amount of dust collected during a certain time interval. Methods of this kind are only roughly indicative and have little comparative or permanent value.

2. Weighing Methods

Numerous methods have been used from time to time of collecting dust either through filter bags, cotton filters, by collecting the dust in a soluble filtering material such as sugar, or by bubbling the air current through water, evaporating and weighing the residue. The methods of collecting dust with filter bags, or cotton filters, are always unsatisfactory, owing to the difficulty of arriving at the correct weight of the filtering material. The material must be dried and weighed with the sample. The absorption of moisture from the air, even during the process of weighing, may increase the weight of the filter to several times the weight due to dust, and accurate results, therefore, require expensive apparatus and skillful technique. Collecting the dust samples by means of a sugar filter, dissolving the sugar and filtering out the residue on special filter paper gives accurate results and is not especially difficult.

Perhaps the best method, however, in arriving at the weight of the dust in a given air sample is to bubble the air through distilled water and evaporate the residue to dryness. This requires no expensive apparatus and the technique is not difficult. The determination of air dustiness by any weighing method, however, is unsatisfactory and the results are of little value.

The *weight* of dust in suspension in the air of occupied rooms has little relation to the harmful effects of dust in question on the human organism. In foundries, where castings are cleaned in tumblers, or in similar operations where iron, or sand dust occurs in the air, the weight of the dust sample may reach apparently alarming proportions. However, the dust itself is not particularly irritating and it is usually sterile. On the other hand, in establishments where clothing is manufactured, or cloth materials handled, in wool sorting, rag picking, etc., an insignificant amount of air dust *by weight* may be a very serious menace to the health of the workers, owing to its infectious and irritating character and also to the large number of particles as compared to heavier substances. We believe, therefore, that weighing methods of dust determination have little value and may be very misleading.

O. W. Armspach has made a very valuable contribution on this phase of dust determinations in his paper entitled "Theory of Dust Action," published in the *Journal* of the American Society of Heating and Ventilating Engineers for December, 1920. The following is quoted from Mr. Armspach's paper:

"In reviewing the work that has been done in connection with air dust and its determination, it becomes evident that little, if any, attention has been given to the particular action of the various kinds of dust particles when suspended in the air. Practically all effort has been given to the method of measuring the quantity of dust and its physiological effects in the body, while the action of the dust itself when suspended in the air seems to have been entirely lost sight of—

"In analyzing conditions of air dustiness in factories, workshops, etc., with a view of improving conditions, in addition to determining the number of particles in the air, it is imperative that a study be made of the conditions at the machines, the size of the room, the kind and size of the dust particle and the *relative time that particles will remain in suspension*. Under certain conditions, the dust content of the air will increase. Under other conditions, the content may remain constant, or even decrease. At the end of definite periods, which may be easily calculated, the dust content will remain constant. For iron particles, the content will remain constant after the first hour, for glass, after the fourth hour, for rubber, after the seventh hour and for leather dust, approximately fifteen hours are required before the results in the room become constant. (The above is as-

suming a constant amount of dust being liberated.) It is, therefore, essential to further progress that a theory of dust action be established—

"Dust for our purposes may be defined as particles of matter so finely divided that they easily remain suspended in the air and the velocity of fall is comparatively low. We may consider them as spheres. The length of time that a particle remains in suspension depends upon its diameter, its density and the viscosity of the air.

"Assuming no slip between the air and the particle, the velocity of fall will vary directly as the square of the radius, inversely as the viscosity of the air and directly as the density of the material. This relation may be expressed by Stokes equation, which is as follows:

$$V = \frac{2}{9} gr^2 \left(\frac{d-d_1}{u}\right)$$

in which V = Velocity of fall in centimeters per second
g = acceleration of gravity
r = radius in centimeters
d = density of the material
d_1 = density of the air
u = viscosity of air

"There is, however, some slip and the true velocity has been expressed by Cunningham as follows:

$$V = \frac{2}{9} gr^2 \left(\frac{d-d_1}{u}\right)\left(\frac{1 + \frac{B}{rp}}{}\right)$$

B = constant
p = barometric pressure in millimeters

"This formula has been experimentally determined by recording the time of fall of minute spheres of wax. *B* was found to equal 0.0075. The value of u depends upon the temperature of the air and is given by the expression:

$$u = \frac{150.38\ T^{3/2}}{T + 124} \times 10^{-7}$$

Where $T = 273.1 + t$

"Assuming *t* to equal 21° C., or appoximately 70° F., the value of *u* will be

$$1814 \times 10^{-7}$$

"Substituting into equation (1) the following values

g = 980 cm. per second
d_1 = 0 (very small relative to d)
$u = 1814 \times 10^{-7}$
B = 0.0075 for 70° F.
$V = (1200540\ r^2 + 11.85r)d$ (2)

"By the aid of equation (2) it is possible to compute the theorectical velocity of fall of the various kinds of dust. There is, of course, an additional force due to air movement and other disturbances, but the equation has much value when comparing the relative action of the various kinds of dust.

"Table 1 was computed by substituting into equation (2) 0.0001 cm. (1 micron) for the value of r. Column 4 gives the time required for various dusts to fall 10 ft. Cork dust, for instance, will fall 10 ft. in 25.7 hours, while iron dust will fall an equal distance in 0.84 hours."

Armspach's conclusions are as follows:

1. The dust content in a room depends upon the density of the material, the velocity of fall of the particles and the size of the room. The dust will accumulate until a definite content is reached, depending upon the rate of fall and the number of air changes.

2. The total dust given off by the various machines when handling different materials can be determined from the average count resulting in the room.

3. Dust conditions can be greatly improved by providing the proper number of air changes.

4. For equal conditions of air dustiness, as the density of the material increases the weight per cubic foot decreases.

5. All dust determinations should be on a basis of the number of particles per cubic foot.

Conclusion No. 5 bears out the writer's position.

Conclusion No. 4 is developed from the theory of dust fall, which illustrates how misleading weight determinations may be. For example, take two rooms, the air of one room containing iron dust and the second room containing an equal number of particles of wood dust. The weighing of an equal sample of the wood dust and iron dust would show the former, viz., the wood dust, to have approximately four times the weight of the latter. This is due to the fact that to have the same rate of fall, which is necessary to give the same number of particles, the wood dust particles would have to be many times greater in diameter than the iron dust particles. We see from this illustration how misleading weighing methods may be.

Armspach concludes as follows:

"Furthermore, the physiological action of the dust in the body and the extent of irritation upon the mucous membrane is a direct result of the number, irregularity and composition of the particles and we are, therefore, little concerned with the total weight of the material. It is quite evident then that a dust determination based upon weight is *extremely misleading* and must be considered unwise."

VELOCITY OF FALL FOR VARIOUS MATERIALS
2 MICRONS IN DIAMETER

Material	Velocity cm. per sec.	Minutes per foot	Time required to fall 10 ft., Hours
Brass	0.1110	4.59	0.77
Iron	0.1015	5.02	0.84
Glass	0.0396	12.8	2.13
Granite	0.0317	16.1	2.68
Limestone	0.0356	14.3	2.38
Slate	0.0370	13.8	2.30
Sandstone	0.0304	16.7	2.78
Graphite	0.0290	17.5	2.92
Brick	0.0277	18.4	3.07
Clay	0.0254	20.0	3.34
Sand	0.0185	27.5	4.58
Coal	0.0198	25.7	4.28
Cement	0.0127	40.2	6.70
Wood	0.0093	54.7	9.15
Cork	0.0033	154.0	25.7
Ivory	0.0241	21.1	3.52
Rubber	0.0255	19.8	3.30

3. Condensation Methods

In "Condensation Methods," mention should be made of the pioneer workk of Professor John Aitken. The Koniscope and Aitken dust counter are representative. The Koniscope is one of the early instruments devised

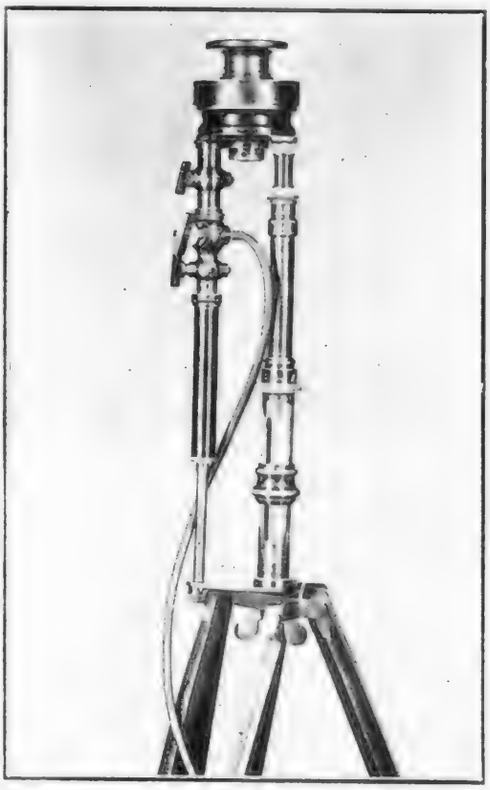


Fig. 15—The Aitken Dust Counter.

by Professor Aitken. It consists of a long tube, lined with hygroscopic material. The tube is provided with windows at each end and is connected at the proximal end to an air pump. A stop cock at the distal end admits the air to be sampled when the pump is operated. After a sample has been drawn into the tube, the stop cock is closed and the air in the instrument rarified by means of the pump. Reducing the pressures lowers the dew-point and produces a fog by the condensation of moisture on the dust particles contained. The density of the fog determines roughly the dust content in the air.

The Aitken dust counter operates on the same principle, except that the chamber of the instrument is vertical and the condensation of moisture on dust particles causes them to be precipitated on a ruled objective glass, where they are counted by means of the microscope eyepiece. Our experience with this apparatus has not been satisfactory, owing, apparently, to the fact that condensation occurs when the air is rarified, even on very minute, perhaps ultra-miscroscopic dust particles. Consequently the count may be very high when the air to all intents and purposes is dust-free.

4. Diffraction Methods

When a beam of light is projected into, or through a dark chamber, the light is invisible if the air is free from dust. If, however, dust particles are present, or moisture droplets condensed on dust particles, the rays of light are broken up, or diffracted and become plainly visible. This method was early used by Professor Tyndall in determining when the air was free from dust and bacteria. S. H. Katz, of the Bureau of Mines, has used with some success a modification of Tyndall's original method, by projecting an illuminated current of air through a dark chamber. If the air is free from dust, the light beam becomes invisible. The distinctness in which the air current appears is directly proportional to its dust content.

By using two streams of air, one before it has been cleaned and the other after, using any dust-removing device, the proportions of dust removal can be found and the approximate efficiency of the device under examination can be determined.

The author's Diffractoscope is a modification of the Aitken machine, in which the presence of dust is detected by means of the diffraction of rays of light by the minute droplets of water of the fog produced by lowering the dew point. It consists of an air-tight metal chamber, 2½ in. in diameter and 6 in. long, lined with hygroscopic material and provided with windows at both ends and on one side. A filter with a three-way cock, which allows air to be drawn through the filter, or directly from the outside, is attached to one end of the instrument and a hose-cock connection for exhausting the air at the other end.

In using the instrument, the hygroscopic lining of the chamber is saturated with water, the three-way cock is turned so that air is introduced through the filter by operating the air chamber at the exhaust outlet. The

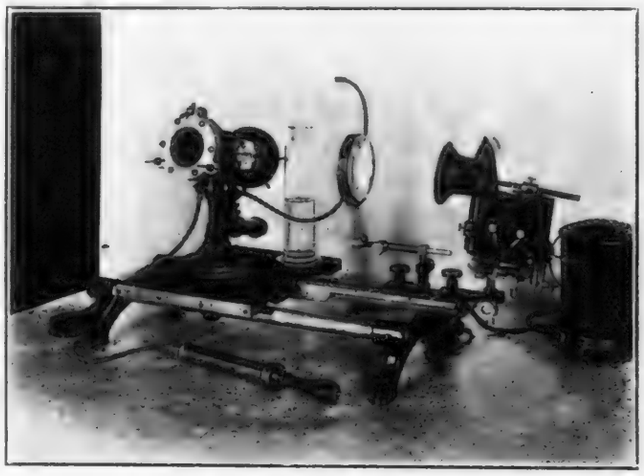


Fig. 16—Dr. Hill's Diffractoscope.

chamber is thus filtered with clean, filtered air. A beam of light is now thrown into the side window from a strong electric arc. If the air in the instrument is free from dust, a reduction of the pressure will not produce a fog and, consequently, the light beam will not be visible. If dust is present in the instrument, a fog will result and the light beam will stand out clearly.

The filter on the diffractoscope consists of a brass tube 4 in. long and 1 in. in diameter, closely packed with fine, washed cotton wool saturated with heavy mineral oil. Air drawn through the filter is dust-free. Air drawn through any ordinary washing or cleansing device, however, even through the Drexel wash bottles at low velocity still produces a visible beam with the diffractoscope, illustrating the fact that ordinary devices for cleaning air do not remove all of the dust. The instrument has little value in determining the relative dustiness of different

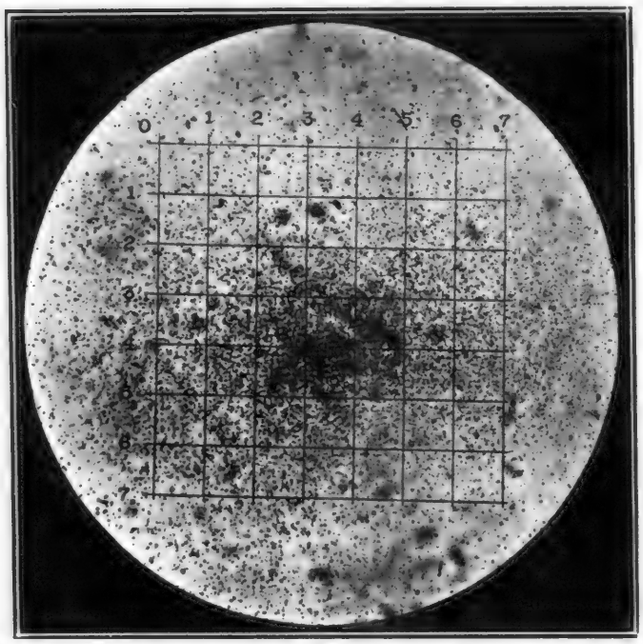


Fig. 17—Dust in Bakolite Factory. (Hill Dust Counter.)

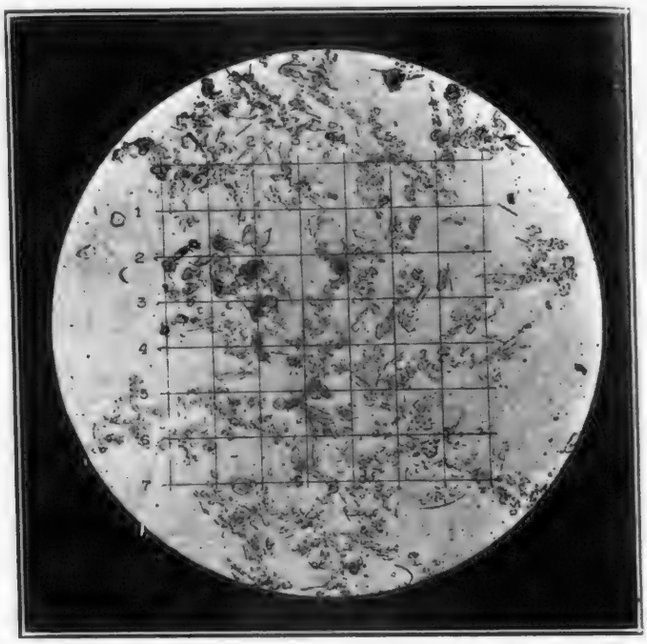


Fig. 18—Dust in Borax Factory. (Hill Dust Counter).

air samples as this can only be measured by the relative intensity of the light beam. It is of considerable value, however, in examining air to see whether or not it is entirely free from dust.

In conclusion, we may assume that the various diffraction methods, although valuable as laboratory devices and in the study of the problem of air dustiness, have as yet no practical application, especially for field work.

5. Counting Methods

There are two more or less practical methods of counting samples of air dust:

First, by collecting the dust under water and counting the particles in suspension in a measured portion of the total volume of water by means of a Sedgwick-Rafter counting cell. This is the method employed in counting when samples are collected through a sugar filter, or with the Palmer apparatus.

Second, by catching and retaining the dust on an adhesive surface.

The former, or Sedgwick Rafter counting cell method, can be shown to contain two serious sources of error sufficient to render the results of no practical value. The first source of error is the breaking up of dust particles when drawn through a water seal and when shaken and otherwise agitated during the process necessary in collecting the sample and in making the count. The extent of this error is evident from the following experiment which was reported by the writer and Mr. Armspach at the summer meeting of the American Society of Heating and Ventilating Engineers, in Pittsburgh, 1919, and printed in the *Journal* of that year.

A clean ½ in. cover glass was smeared with clean syrup and lightly charged with dust. A second clean cover glass was superimposed and the sample placed in the stage of the microscope and carefully counted. The total count of particles on the cover glass was 1,785. Next 35 c. c. of clean, distilled water were shaken in a cylinder graduate for one minute. A sample of this water was placed in the counting cell and counted longitudinally across the cell. The average per field was 2.5, or the total number of particles in the sample of 35 c. c. was 87,500. The sample upon the cover glasses was then dropped into the solution and shaken for one minute. During this operation, two cover glasses separated, the syrup passed into the solution and the 1,785 dust particles contained between them were liberated. A portion of the sample was then removed by a pipette placed in the counting cell and a count made. The average number per field was 11.1, or a total for the entire sample of 388,500.

Subtracting the total dust particles in the original liquid, we have 388,500—87,500, or 301,000 dust particles now in the liquid from the 1,785 particles counted in the original cover glass specimen. In other words, 1,785 dust particles shaken in the water have broken up into 301,000 particles.

It is perfectly clear from this experiment that in collecting dust samples under water, shaking the sample and making the count with the Sedgwick Rafter cell, we obtained from one hundred to two hundred times the number of particles that existed in the air samples. This error is sufficiently serious to condemn the method.

There is another, however, that is equally as bad. The Sedgwick Rafter counting cell consists of a rectangular frame of brass mounted on a standard glass slide for microscope work. The interior of the cell measures 20 x 50 millimeters and is 1 millimeter deep, so that the cubic content of the cell is 1 c. c. In counting, a sample is placed in the cell and a thin glass slide placed carefully over the same so as to exclude air bubbles and insure the exact quantity of 1 c. c. in the cell.

(*To be continued*)

Conservation of Coal by Large Consumers

How Proper Supervision and Study Met the Rising Fuel Costs in New York State Institutions

By G. B. Nichols
Consulting Engineer

IN NEW YORK STATE the public institutions are among the largest consumers of coal. For this reason they have felt very keenly the acuteness of the coal situation which has existed for a number of years. Prices per ton have continued to rise and, to make matters worse, it has been almost impossible at times to obtain coal at any price. It is now predicted that we are again to have difficulty in obtaining our commercial supply of coal this coming winter.

At present eleven of the New York State hospitals, with a population of 29,496 insane patients, consume yearly 156,369 tons of coal, or a consumption per inmate of 5 3/10 tons per year. This may appear a very large figure but this coal supply furnishes heat for heating the plants heating the hot water supply, steam for the generators to supply the power and light and also for cooking. The total cost of this amount of coal, based on $5.00 a ton, would be $780,000 per year.

For a number of years prior to 1918, the state authorities felt that the institutional plants were operating very inefficiently, and that if some study and supervision could be inaugurated at these plants, there would be a very great saving to the state in the coal supply. In 1918 it was decided that such a plan of central supervision should be inaugurated in the Engineering Department of the Department of Architecture. This was brought about by a preliminary study which has been carried on for a number of years at the Soldiers' and Sailors' Home in Bath, N. Y., in which the yearly coal supply has been reduced almost 50% by bettering the operating conditions. At this institution, there were burned in 1914 and 1915, 16,335 tons of coal. In 1920 the same institution burned only 7,325 tons, the number of buildings remaining practically the same.

HOSPITALS REPORTING ON LOG SHEETS

INSTITUTION	1917-1918		1918-1919		1919-1920		1920-1921	
	AVE. DAILY CENSUS	COAL CONSUMED LBS.	AVE. DAILY CENSUS	COAL CONSUMED LBS.	AVE. DAILY CENSUS	COAL CONSUMED LBS.	AVE. DAILY CENSUS	COAL CONSUMED LBS.
BINGHAMTON	2712	23,740	2673	13,832	2700	18,262	2644	[a]17,541
BROOKLYN	863	4,306	930	4,974	1090	5,684	1189	5,788
BUFFALO	2194	11,802	2202	12,640	2163	12,126	2176	[a]12,447
CENTRAL ISLIP	4951	35,530	5155	30,589	5330	33,435	5387	29,070
GOWANDA	1284	11,431	1278	12,095	1250	[a]10,291	1234	[a]9,000
HUDSON RIVER	3432	24,879	3387	21,346	3423	[a]24,612	3451	[a]20,797
MANHATTAN	5083	29,810	5352	39,384	5427	24,790	5820	21,956
MIDDLETOWN	2203	8,269	2125	12,759	2091	[a]9,022	2083	9,746
ROCHESTER	1593	7,516	1529	8,117	1556	8,224	1606	7,435
ST. LAWRENCE	2260	17,268	2230	16,043	2215	[a]15,307	2247	[a]14,800
UTICA	1686	7,938	1651	8,924	1662	7,216	1659	7,789
TOTALS	28261	182,489	28512	180,703	28907	168,969	29496	156,369

NOTES: Coal figures to the right of heavy line indicate years in which the hospitals have reported on power plant log sheets which have been checked by the department of agriculture.

a - Weight corrected by annual inventory

Kings Park is not tabulated on account of lack of complete data.

HOSPITALS NOT REPORTING ON LOG SHEETS

INSTITUTION	1917-1918		1918-1919		1919-1920		1920-1921	
	AVE. DAILY CENSUS	COAL CONSUMED LBS.	AVE. DAILY CENSUS	COAL CONSUMED LBS.	AVE. DAILY CENSUS	COAL CONSUMED LBS.	AVE. DAILY CENSUS	COAL CONSUMED LBS.
WILLARD	2345	11,802	2379	14,148	2427	13,249	2389	13,512

Fig. 1—Coal Consumption for Four Winters from 1917 to 1921.

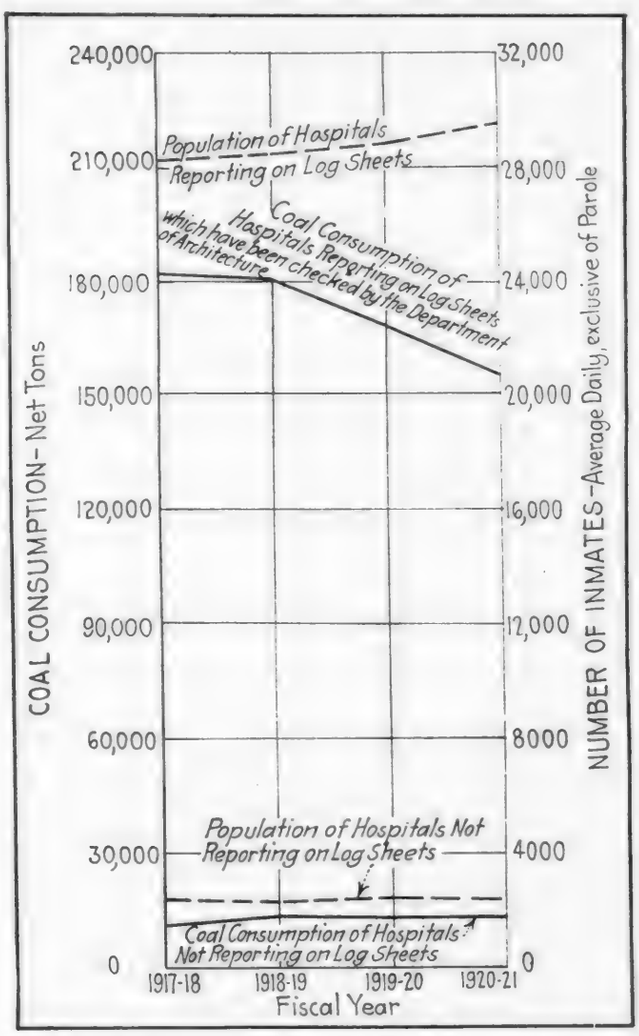


Fig. 2—Chart Showing Savings Effected in Coal Consumption in Power Plants of New York State Hospitals.

GENERAL PLAN OF SUPERVISION

The plan in general consisted of the establishing of

a small bureau at the Capitol, the first work of which would be to place in the hands of the operating engineers, certain standard forms of log sheets, so that each engineer could hourly report the quantity of coal burned, water evaporated, quantity of domestic hot water used, electric power and light and any other features served from the power house, besides giving the amount of labor necessary to operate the plant. These daily log sheets were kept in duplicate, one copy to be retained at the plant, in a loose-leaf binder, and the other to be forwarded to the central bureau for re-capitulation. At the central bureau these log sheets were carefully studied, and at the end of the month, a summary sheet was made out reducing all services to rate per capita, and sent to the local superintendent, with a sheet of suggestion, whereby the operation might be improved. At certain plants it was found that the engineers were operating on certain standards which produced better results than at plants where these methods were not employed, and it was suggested to try out this method and watch results. If a plant continued to show poor results an engineer was sent to the institution who was to stay there long enough to make tests and to determine what the difficulty was, and suggest what might improve the operation.

The moral effect of these reports was very striking, and immediately the coal consumption commenced to drop. There seemed to be an awakening along the line, from the firemen to the chief engineers, and they appeared to understand that the time had arrived when a definite study should be made of the various operations and the most economical plan of operation carried out.

ANALYSIS OF RESULTS

At Binghamton State Hospital it will be noticed that the population has fallen off slightly from 1918 to 1921. Additional buildings have also been added so that the space heated is greater. The coal bill has been reduced from $23,740 to $17,540. At the Brooklyn State Hospital there has been an increase in the coal consumption, and this can easily be accounted for in the larger number of buildings served; the population has also increased materially. At the Buffalo State Hospital, the coal reduction has been very slight, showing undoubtedly that this plant was doing the best that it could before the service was inaugurated. At the Central Islip State Hospital the population has materially increased, and the coal bill has been greatly reduced, dropping from $35,930 to $29,070. At Gowanda State Hospital the population has remained constant, while the coal bill has dropped materially. This same would apply to the Hudson River State Hospital.

At the Manhattan State Hospital a peculiar condition has existed, namely, in 1918 a new plant was installed, with a very much up-to-date equipment. The first year that this plant was run, due to the inexperience of the operating force in running the new type of equipment, a very great increase of coal was consumed. In 1919, however, this condition was improved, and at the present time there is a large amount of saving over the original consumption, before the new plant was installed. The population has also increased materially.

At the Middletown State Hospital the coal consumption has been holding quite constant, although there have been quite a large number of new buildings built, which have not as yet increased the population materially. At Rochester State Hospital there has been a slight increase in the efficiency of the plant. At the St. Laurence and Utica State Hospitals the coal consumption has been reduced. At the Willard State Hospital, there are a number of isolated plants which are out of repair, and the institution thus far has made no attempt to report their operating condition or to keep any systematized records. It is to be noted that the population has remained constant and there is no material change in the coal consumption. There is no doubt that a large saving could be made at this institution if the problem was properly analyzed and it is absolutely essential that new and more modern equipment be installed.

PRINICIPAL FACTORS CAUSING FUEL WASTE

A great deal of saving can be brought about by proper supervision and study of the combustion problem. Another point of loss is the numerous steam leaks which are allowed to continue to blow for long periods. A third great loss is the amount of uncovered pipes and hot surfaces without covering. It should be a general practice in all heating plants to cover the pipes with the very best covering, as the price of same is a very small amount as compared with the loss in heat over a short time. In large plants labor-saving devices should be installed as far as possible, as the reduction in labor should help out a great deal in solving the labor shortage which we are now encountering.

Steam Requirements of Buildings and Cars

By T. W. Reynolds

Formulas for estimating the amount of coal for heating buildings have been in use for several years. There is the Tweedy formula which employs the glass and wall surface and uses a value derived from operating data of a number of buildings, the Boyden formula which is somewhat complicated, but considers more variables, and the government method of assuming the condensation of 500 lbs. of steam per square foot of radiating surface per season.

It is a good practice to use all three methods as a check and then compare the results with the known requirements of similar buildings. This can be readily done by referring to the Handbook of the National District Heating Association, wherein the above formulas are given, as well as the *steam requirements for over 100 buildings of various types in cities of several States. Further data in the way of curves, as given therein, show the cost of operation based on meter readings, also the cost per 1000 cu. ft. of gross volume; for though the amount of coal required depends largely on the amount of wall and glass surface, yet it has been found that the total cost of operation bears a fairly well-defined relation to the volume of the building.

Other interesting data may be obtained from THE HEATING AND VENTILATING MAGAZINE, for January 1923 and July 1922. In the latter issue, a set of curves on the amount of steam used for heating certain build-

* Given also in Lefax Engineering Data Sheets, and *Journal American Society Heating and Ventlating Engineers*, Janary, 1916.

ings show suprisingly close agreement whether based on (1) the volume, (2) the total exposed surface, or (3) the radiator surface. It may also be said that one large realty company finds 4,000 B. T. U. per cu. ft. of volume per heating season giving results for office buildings approximating those obtained by the meters which they use to determine actual consumption.

This is a safe figure to use as will be found if the data given in the Handbook is worked out for this relation, but wherever the average outdoor temperature is extremely low, this figure should be raised to 5,000 or more, or 0.5 B. T. U. can be used per day per degree of average temperature difference between the rooms and outdoors. For instance, if the average temperature is 34° with 220 days in the heating season, the B. T. U. per cubic foot of volume yearly would be 3,960.

DETERMINING STEAM REQUIREMENTS OF PASSENGER CARS

As for car heating, sometimes a flat rate charge of 185 lbs. of steam per car per hour is used with steam at 80 lbs. pressure. Though this method is not as accurate as meter records, it will at least approximate conditions, judging from meter records taken at two large terminals for the month of February, 1916. During this time, accurate records were kept of car hours, temperature, etc., the results showing 198 lbs, in the one case, and 178 lbs. in the other, distribution losses included. Details of these data and other car heating statistics were published in various issues of THE HEATING AND VENTILATING MAGAZINE during the last year or so, one issue, that of December 1921, presenting curves of the heat required by passenger coaches as compared with the heating per cubic foot of the Biltmore Hotel.

A better method to use in determining car heating charges is that obtained by the use of meters which measure the actual steam consumption. This method gives the best results in terminals used by only one railroad, but even in terminals used jointly by two or more railroads (where it is impossible to segregate the heating lines for each user), it is still better than a flat-rate charge.

In a joint terminal, operating conditions require that cars of each railroad use any track and steam connection conveniently at hand, so that it is seldom found practical to meter the separate use of steam by each railroad. The joint consumption can still be measured as accurately as before, but, in the absence of separate meter records, the cost of producing this total amount of steam must be pro rated against each railroad on the "wheelage basis," that is, the car hours of usage by each railroad.

CONDITIONS WHICH AFFECT STEAM CONSUMPTION IN CARS

Though, as stated, this is a better method than any other for like conditions, it erroneously assumes that the steam consumption for any car hour is equal to that of any other car hour. This cannot be so because of certain variables which this method as now used or any other method cannot take into account, but if this method were improved in some respects, it would be possible to take into account, to eliminate, or at least reduce these variables, as will be shown in the concluding paragraphs. Now, the steam used per car hour will not be the same with each railroad, as the equipment and practice of railroads vary, not only as one railroad with another, but also as between the cars of the same railroad. Certain railroads may leave many of the car windows, doors, and ventilators open, thereby increasing the heat loss, and preventing the economical operation of devices for temperature control, but in the case of other railroads who use the same terminal jointly, this practice may be seldom allowed, if at all.

The number of cars connected cold to the distribution lines will also vary at times, and with each railroad, and each car so connected will require more steam for one or more hours while warming up than for the same duration of time when the desired temperature is being maintained. Also, heating systems in cars of each railroad vary in type, in make, in service condition, and in temperature control. For instance, in some the thermostat is set to maintain the temperature of 70°, but in others the thermostat is set for 50° only, and what is worse, still others have no such limit control and overheat.*

The volume and amount of exposed surface of each car of each railroad should also be taken into account, as well as the construction of the car, whether of steel or wood. Besides these things, the underbody piping of a car is exposed and often requires renewal of lagging, while the physical conditions of steam distribution vary with the practice of the particular railroad, though in most cases it is usually bad. For instance, as a general rule, much of the piping is laid in wet ground and poorly insulated, steam traps defective, and couplings leaky, so that tests often show distribution losses to be about 50% of the total plant output.

HOW EXISTING CONDITIONS OF CAR HEATING COULD BE REMEDIED

If most of these conditions are recorded, eliminated, or improved, and they could be, then the "wheelage basis" would give truer proportionate charges than is possible by its present application. Thus, the "wheelage basis" could be improved considerably and the variables reduced, first, by taking hourly readings of the temperatures in each car, and by noting whether the car was connected cold to the distribution lines. Next, the number on each car could be recorded in order to select from office data the steam consumption of the car (as fixed according to its type, construction, and the like) for the temperatures and conditions noted. Then, assuming the proper maintenance of equipment and inspection of heating conditions, the records would show a different steam consumption for each car hour and this is what actually takes place.

Now, the joint steam consumption could be obtained as before from meter records, but the cost of producing this total amount, instead of being pro rated against each railroad according to its hours of usage, would be pro rated according to its steam consumption, as estimated from the records for the car hours of each railroad.

* Usually 80°,—sometimes reaching 145°. Tests have shown possible savings 50 lbs. of steam per hour per car, if temperature control is used.

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AS IF timed in advance, the publication of this Seventh Annual Fuel Conservation Number comes almost simultaneously with the beginning of another strike in the anthracite coal industry. Whether or not the strike is of long duration, the temper of the public has already reached the point where the decision has been made by many to use substitutes for hard coal. The government endorses this practice and is urging the more extended adoption of coke and, if worst comes to worst, of soft coal.

It is not necesssary here to dwell on the cause or progress of the strike. The situation, however, must have a profound interest for heating engineers in bringing home to them once more that the days of anthracite are numbered and that the time is perceptibly nearer when the problem of the satisfactory handling and smokeless, economical combustion of substitute fuels will have to be met and solved.

At the same time, the continued high cost of coal is driving the householder to take better means of conserving his fuel supply, of looking more closely into the matter of air leaks in his house construction and of studying means of regulating the temperature in his home.

THE fact is that in spite of the known advantages of temperature control, the average American home is notoriously overheated. Heretofore the initial expense of installing devices to reduce the coal bills has seemed to many to more than counterbalance, at least for years, the possible savings to be effected in the burning of coal. But today the situation is different. In many cases it can be shown that the entire cost of a temperature-control system can be made up in one season's operation. In other words, from a general argument for coal conservation for the benefit of future generations, the matter has come down to a money-saving proposition for each and every householder and therein lies the chief impulse that is placing him in a receptive mood for adopting fuel-saving equipment and which is opening up a wonderful opportunity to those who have such equipment to sell.

AS IN former years, inquiries are reaching us from all kinds of sources regarding fuel-oil and gas as substitutes for coal. The adoption of fuel-oil in many office buildings in the East, in recent months, has made a tremendous impression on these people, who are mostly houseowners, and their impression is one of saving first and convenience afterward. It is not necessary to tell heating engineers that the economy argument does not apply to either fuel, except in such localities where the coal prices are above $15.00 a ton; their usefulness is based upon other grounds, such as cleanliness and comfort. There is, however, a very distinct economy in the burning of the smaller sizes of hard coal and the whole tendency of boiler design is towards the use of these smaller hard coals and soft coal.

FOR the first time, so far as we know, the government has started a national campaign to educate the public in the more economical use of the different fuels. To this end it is announced that the United States Coal Commission and the Federal Department of Commerce have enlisted the aid of the Federated American Engineering Societies to study special aspects of the coal problem. A group of 500 engineers is actively directing the study, under the guidance of the main committee, headed by W. L. Abbott, of Chicago. The committee, it is stated, will gather facts regarding consumption and storage of coal, spontaneous combustion and storage cost. The feasibility of substituting oil for coal and bituminous for anthracite, it is added, will also come up for discussion. Due possibly to the fact that the American Society of Heating and Ventilating Engineers is not a member of the Federated American Engineering Societies, heating engineers are conspicuously absent in this work which, in many respects, would seem to be directly in their field.

JUST now, when unit ventilation and ozone are so much in the public eye, the sequence of events connected with their development, in one important center, is worth noting. First, we have the trend towards recirculation of air in the duct systems and the use of ozone. Then comes the unit ventilation idea and the discovery is made that, being a direct current proposition, it will not jibe with ozone, which requires alternating current. This seeming impasse is happily solved by the discovery that the diffusion secured with unit ventilators makes ozone machines superfluous. To the average man on the street, these kaleidoscopic changes in practice suggest the query, "Where do we go from here?"

Successful Fuel-Saving Ideas

How to Burn 30% Less Coal and Still Keep Warm

"The homes in which our families live 24 hours a day," writes William H. Driscoll, vice-president of the Thompson-Starrett Company, in *Popular Science Monthly*, "certainly deserve more attention from heating engineers than the office buildings in which we spend only eight hours a day. Yet homes have been neglected, while the heating of office buildings has become a science. Personally, however, I have derived more genuine pleasure from installing hygienic and economical heating systems in little bungalows than from my biggest jobs."

In enumerating the faults of the average house heating installation Mr. Driscoll starts with the basement. In some cases, as he points out, the heat leaks into the cellar instead of being carried to the rooms upstairs. Sometimes the fault is in bad design of furnace, boiler, or chimney; more often it is faulty installation. Sometimes the fault cannot be easily remedied, but there is hardly a house-heating plant in existence that cannot be improved by any man possessing ingenuity and some mechanical skill.

Mr. Driscoll quotes from the results of the tests conducted at the University of Illinois on the insulation of warm-air ducts, showing how the usual single-coating of asbestos paper actually increases the heat radiation from that pipe as much as one-third. "This series of experiments," he continues, "indicates a general rule for insulation against heat or cold that the amateur heating engineer will find constantly useful. When insulating against low temperatures (warm air pipes, the heat or cold of outdoors, etc.), the best insulation is closed air spaces; but in insulating against high temperatures (furnace walls, steam pipes, etc.), use a solid insulator such as asbestos or magnesia."

REMEDYING DEFECTS IN THE BUILDING CONSTRUCTION.

"The proper insulation of a house against outside weather is too often neglected by the builder of small houses. It is hardly an exaggeration to state that fully 40% of the heat losses in the average house can be attributed to this neglect—the leakage of air through walls and around windows and doors. But while the householder cannot very well tear down a wall to correct these defects, he can at least take the following precautions:

"See to it that there are no holes at the top or bottom of the walls by which air can circulate from the cellar to the attic. If there are such holes, cover them with building paper or wallboard. It is a common thing to find that the insulation of a house has been applied effectively except to the ceilings of the top floor, where only one thickness of plaster separates a warm room from a cold attic. In this case, tack building paper over the tops of the rafters to inclose air spaces over the ceiling. Over-hanging rooms, with no cellar beneath and only one thickness of boards on the floor, are often fatal to the operation of the heating plant.

"Storm windows and doors (especially on the north and west sides of the house) and weather stripping will frequently save their cost in fuel in a single season and are among the ordinary precautions that ought to be taken."

One of the indications mentioned by Mr. Driscoll, showing that a heating plant is wasting coal is a warm cellar. The usual cause of a too-warm cellar from a warm-air furnace, he states, is poor circulation of air within the furnace which, in turn, may be due to a wrong layout of the warm-air pipes overhead or, more likely, wrong construction of the cold air duct bringing air to the furnace. The intake pipe ought to have an area in cross section practically equal to the combined area of all the warm-air pipes.

First aid for most furnace troubles, it is stated, consists in enlarging the cold-air duct. In doing this, we ought to avoid the old, old mistake of taking all the cold air from outdoors.

"It is a mistaken idea," declares Mr. Driscoll, "that it is unhealthful to recirculate the air in the house. One investigator estimates that 90,000 cu. ft. of air an hour is needed to heat the average house of eight rooms and bath. If ten persons constantly occupied this building their maximum requirement for fresh air would be 18,000 cu. ft. an hour. As a matter of fact, the infiltration of air about windows and doors would bring in about that quantity of fresh air and it is simply a waste of fuel to heat the total quantity of air passing through the furnace from the outside temperature, instead of reheating the already warmed air in the rooms."

Speaking of the use of an auxiliary fan in the inlet duct to accelerate the circulation, Mr. Driscoll endorses the practice, stating that if the furnace works all right in mild weather, but fails in extremely cold weather, relief may be obtained by placing a small electric fan in the inlet duct to blow air to the furnace and thus cause a brisker circulation throughout the whole system. The fan, he adds, would be used only in warming up the house in the morning or in extremely cold weather. It is a matter of record that an ordinary electric fan installed in this way will double or triple the capacity of the heating system.

When a fan or blower is used, however, all air must be taken from inside the house, that is, recirculated.

On the subject of humidity, Mr. Driscoll make some interesting suggestions. After calling attention to the prime importance of humidity in domestic heating work, he declares it to be the most thoroughly neglected of all the items involved. Mr. Driscoll recommends, as one of the first steps in remedying the condition of insufficient humidity, the purchase of a hygrometer, the next step being to devise some method for supplying humidity to the air.

A great deal more water is needed for this purpose, he states, than is generally supposed. The usual warm-air furnace has a water pan in the bottom holding a gallon or so of water, and occasionally some one remembers to fill the pan. But for all the good it does, it might as well be forgotten. A pan of this sort actually supplies less moisture to the air than a human body gives off in a day, and affects the humidity of the house scarcely at all. In order to maintain a humidity of about 50% at 70° in the average seven- or eight-room house, we must evaporate into the air from 17 to 20 gal. of water a day.

In concluding, Mr. Driscoll calls attention to the modern warm-air furnace construction which provides a cast-iron evaporating pan on top of the fire-pot, inside the furnace shell. This pan is connected by pipe with a tank on the outside of the furnace in which the water level is the same as in the pan inside. A water valve controlled by a float, of the type used in toilet tanks, keeps the tank constantly filled with water. Care should be taken in making such an installation to equip the outside tank with an overflow pipe, so that if the float valve fails to operate, the furnace will not be flooded inside.

As far as the application of the various types of humidifiers to steam and water radiators is concerned, Mr. Driscoll considers these of doubtful value. The problem of humidity in such cases, he states, is most easily solved in a steam system, by the use of a small noiseless and adjustable valve that allows some of the steam to escape directly into the air of the rooms. For the water heating system, however, no simple method of obtaining the desired humidity has been suggested.

Reducing Coal Bills in the Woolen Industry

A way has been found to reduce the coal bills of the 1460 woolen bills in the United States by more than 15½, according to a survey just completed by engi-

neers in the textile research division of the Johns-Manville Company.

The method arrived at, it reported by J. H. Walsh, chief of the division, is to increase the efficiency of the present drying apparatus by the use of insulation and by improvement in air circulation. The statement is made that by the efficient insulation of housings, a higher temperature can be secured, thereby resulting in the highest temperature with the lowest steam pressure, and the smallest amount of heating surface.

Tests conducted under the direction of Mr. Walsh, at certain large mills in the New England district, showed that the average dryer as installed, without insulated housing, requires 2.5 lbs. of steam to remove 1 lb. of moisture from material.

When the housing was constructed in accordance with an improved method of insulation and air circulation used, it was found that the removal of 1 lb. of moisture necessitated supplying only 1.6 lbs. of steam, affording a saving of 36% in the amount of steam required for the dryer coils.

Expressed in terms of coal, the possible saving to the woolen industry in the United States, says Mr. Walsh, by use of proper insulation, is 88,800 tons per year, together with an increased production in drying stock or yardage.

Burning Coal Upside Down

By Lloyd E. Harter

The open season for smoke abatement and fuel-saving propaganda is here. The press is devoting much space to a discussion of this subject. While it is not precisely a timely topic for the dog days, it is, nevertheless, none too soon at that if anything is to be accomplished during the coming winter.

When we appreciate the way we burn coal it no longer seems strange that we suffer so much from smoke, soot and waste. You wouldn't hold a candle with the wax above the flame and the wick down. Nor would you feed the fuel to the kerosene lamp from the bowl ABOVE the flames. Likewise gas fuel comes from *beneath* to the gas stove burner above. In fact, everything we burn for heat or light, we feed from below. This is the natural, scientific way to consume anything with relatively perfect combustion and control.

But the one great exception to this normal method of feeding fuel is in our burning of coal. Instead of delivering our coal to the fire from below, which is the right way, we shovel it in on top of the fire and the flame, which is the wrong way. And, of course, we suffer from the soot and smoke and waste that inevitably results. If you hold your candle so the flame is below the tallow, you will have soot and smoke and waste instead of relatively perfect combustion, such as you will have when the candle is held right-side up.

In the big, high-pressure plants, engineers have fully appreciated this principle. They are employing almost everywhere the under-feed stoker because it feeds the coal to the flame in the right way,—from below. However, there are hundreds of thousands of smaller plants, such as all the domestic heating furnaces and boilers, which have to be stoked with a shovel. And you can't shovel coal up through the grate. A shovel can not be used and deliver the coal any place but on top of the fire. We know this is not right, but we simply cannot avoid doing it that way so long as we have to use a shovel, and no doubt we will go on with this most handy tool for a long time to come.

Large quantities of gases are driven off of the green coal shoveled in on top, by the heat below it. If these gases are not burned they pass off as soot, smoke and CO, which is invisible waste. It is variously estimated that this waste amounts to from 40% to 60% of the heat units contained in the coal shoveled in.

It is a mistake, however, to suppose that this imperfect combustion can not be largely mitigated.

The United States Government experts have made an exhaustive study of the subject. They have laid down the rule that "one-half of the air for combustion should be taken in under the fuel bed and one-half over the fuel bed." It is impossible to take in all of the air necessary for combustion through the grate even if it were forced in. The oxygen in this air is all consumed in the first 4 in. from the grate so that green coal on top which needs oxygen so badly gets none at all from below.

There are several ways to remedy this bad situation. One of the best and most inexpensive ways is to introduce hot air *over* the fuel bed to mix with the rich gases and complete their combustion. Two things are necessary in introducing this "secondary" air. First, it must be hot air—that is, its temperature must equal that of the gases. Second, it must be sprayed out over the fire in a thin fan-like film so that it thoroughly mixes with the coal gases.

It is plainly to be seen that the mere opening of the so-called "check draft" in the feed door will not help the combustion. It supplies cold air and the air does not mix with the gases. Really it does what its name indicates—checks the fire.

A Heating Engineer's Notes on Manchuria

The many friends of F. C. Heiles, who is in Manchuria superintending the installation of a heating plant and ventilating plant in the largest hospital in the Far East at Darien, for the George A. Fuller Company of the Orient, Ltd., will be interested in a letter received from him which we are glad to pass on to our readers:

"We had a wonderful trip out," he writes, "and have learned many new things, even in the heating line. Things are so different out here from what we are used to that a comparison is almost impossible. I have come to the conclusion that 90% of the descriptions of Japan and China that we read at home are written by people who have never seen either.

"The Japanese may not all be as clever as we are led to believe, but they are aggressive. If there is anything going on that is new, they want it and wish to learn all about it.

"When I arrived here I first got in touch with the government office and got the data on the climate. I was surprised to find a most complete record of temperature, humidity, wind velocity and rainfall. The great difficulty here is the very low humidity in winter.

"I am enclosing a picture of the method used in heating the majority of buildings. This, as you can imagine, makes the town very dirty in winter, especially since only soft coal is used. Air washers are unknown so far.

Each Room in this Darien Building Is Heated Separately by a Stove Burning Soft Coal.

"The hospital that we are building will be the largest in the Far East. It will be heated by a vacuum return-line system and ventilated by means of a fan and duct system, with air washers, and temperature and humidity control. The hospital will be wired for both A. C. and D. C. current, and the plumbing will be of the very latest."

Increasing Demand for Smokeless Boilers

A distinct increase in the demand for steel firebox heating boilers, especially of the smokeless type, during the last year or so, is reported by the Brownell Co., Dayton, O. The company states that it expects this field to broaden each year in heating work where the installations require 1000 sq. ft. of radiation or more.

APPRENTICE EDUCATION, A SURVEY OF PART-TIME, EVENING AND OTHER FORMS OF EDUCATION, has been published by the Federal Board for Vocational Education, as Bulletin 87 of the Trade and Industrial Series No. 25. Copies available for free distribution will be mailed on request to J. C. Wright, director, 200 New Jersey Ave., N. W., Washington, D. C. The bulletin is also on sale by the Superintendent of Documents, Government Printing Office, Washington, D. C.

Getting Customers to Reduce Their Costs by Buying Steadily

The scheme evolved by the American Radiator Company and described in THE HEATING AND VENTILATING MAGAZINE for May, 1923, for varying the prices of heating equipment according to the cost of production during the year, has been made the subject of a special article by Clarence M. Woolley, president of the American Radiator Company, appearing in *System* for August, 1923.

To illustrate his point, Mr. Woolley cites a typical case of the method followed in home building. "In the Fall," he says, "John Jones decides he wants to build a house. He approves the architect's plans and in January or February lets the building contract. The heating contractor, if he decides to buy from us, then enters into what we call an 'F.D.' contract—that is, a contract for future delivery. He does not often give us his exact specifications. The building of the house goes forward. Along about September the building is sufficiently advanced for the contractor to think about the delivery of his boiler and radiators. He gives us the exact specifications and asks for delivery at once. Thousands of other houses are in the same condition as the one that John Jones is building; thousands of other heating contractors are doing what John Jones' contractor is doing; thousands of owners all over the country are trying to get their heating plants in order before the cold weather sets in. About 50% of our year's business is jammed into three months."

As Mr. Woolley states, building in the sections which require the most heating apparatus is controlled by the weather. The company's greatest markets, he says, lie where construction work has to stop during the winter. The seasonal pressure of the company's business is occasioned by the uncontrollable factor of the weather.

In explaining how the company came to adopt its present policy of varying the prices of heating equipment according to the cost of production at different seasons of the year, Mr. Woolley stated that a study was made of the productions and shipments over a period of 20 years. It was found that the company's year divided itself into five seasons or periods.

The first period includes February, March and April, which is the best time of the year for foundry work. During that period the company's production reaches its highest efficiency and naturally the costs are lowest, but during this period the company ships less than half of its production. The balance has to go into storage.

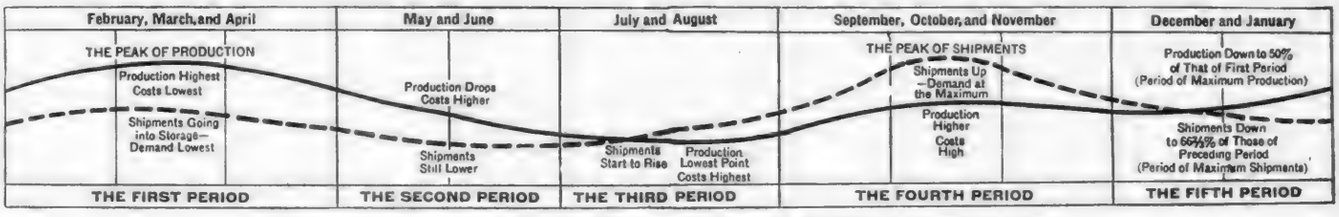
In the second period, which is May and June, production drops about one-third, due largely to the warm weather, and the shipments are about two-thirds of production.

In the third period, July and August, the low point of factory production is reached. On the other hand, for the first time during the year, shipments exceed production.

The fourth period, including September, October and November, is properly termed the rush period. During these three months, says Mr. Woolley, the company presses for production, but it can rarely get more than two-thirds of the high point production.

Coming into the fifth period, Decembre and January, the pressure ceases all at once. Shipments drop two-thirds and production is cut in two.

Mr. Woolley then goes on to explain the company's new method of stimulating sales during the dull periods by reducing prices, as explained in THE HEATING AND VENTILATING MAGAZINE for May.



Variations in Production and Shipment Curves During Course of Year.

Adoption of Unit Ventilation by New York City Board of Education

Details are now available of the report of the meeting of the New York City Board of Education which adopted the unit ventilation method of ventilation for the public school buildings of New York City, as reported in THE HEATING AND VENTILATING MAGAZINE for July, 1923. At a meeting of the board on May 3, William H. Gompert, architect for the board, reported that a meeting was held at his office on April 20, 1923, to discuss the advisability of changing the type of heating system in future school buildings to be erected under the jurisdiction of the Bureau of Construction and Maintenance, from the present central supply split system to the unit system of heating and ventilation. There were present the following:

John A. Ferguson, M. D., Chairman, Committee on Buildings.

Dr. Edward B. Shallow, associate superintendent of schools.

William H. Gompert, architect, Board of Education.

Amos Smith, engineer, Board of Estimate and Apportionment.

R. W. Rodman, superintendent of plant operation.

Frank G. McCann, chief of heating and ventilation division, Bureau of Plant Operation.

Messrs. Dobbin, Lindsay, Kiewitz and Thomas, of the Bureau of Construction and Maintenance.

After an extended conference discussion and conference on the subject, it was decided by unanimous vote to adopt the unit system of heating and ventilation in future school buildings.

In advocating the change to the unit system, Mr. Gompert gave as his reasons:

"To eliminate large and expensive apparatus which at times is idle. The installation of the unit system will effect a saving of from 5% to 10%, which represents approximately from $3,000 to $7,000 per building, depending on the size and type.

"The unit system would obviate large apparatus rooms, underground ducts and deep basements, thus effecting a saving of not less than 8% which on an A-type, 48-class room building, would amount to approximately $50,000 to $60,000.

"Eliminates heavy heat losses between central heating chambers and rooms.

"Reduces fire and panic risks by doing away with passes afforded for smoke through ducts, should fire occur in basement.

"A room may be ventilated only when occupied, thus each room becomes an individual system.

"Allowing rooms for 'after-hours' use to be ventilated separately, whereas in a central system it becomes necessary to operate the entire plant to serve individual rooms.

"Allow for quick heating by recirculation.

"Unit becomes a direct radiator for night use by closing outdoor damper and opening recirculating damper.

"Expense of ventilating unoccupied rooms eliminated.

"Direct radiators in same rooms with units become operative only in extremely cold weather.

"Decreased motor horse power for volume discharged, eliminating loss due to duct resistance.

"A room can be ventilated or air recirculated at will with the psychological effect of seeing the source which makes possible the bringing of fresh air directly into the room.

"I have examined schools in Yonkers, N. Y., and Paterson, N. J., where the unit system is installed, and we have had representatives from this bureau make investigations in schools on Long Island and in the State of New Jersey, accompanied by Mr. Amos Smith and Mr. Riordan, of the Board of Estimate and Apportionment. Mr. Rodman informed us that he visited

schools in New Jersey where the unit system is installed. The result of all these investigations is an endorsement of the proposed change.

"I submit herewith replies received from architects connected with the boards of education in various cities and also private practising architects who are experts on school buildings, and by a large majority these opinions endorse the unit system of heating and ventilating.

"I have brought the matter to the attention of Mr. Ettinger, who approves the decision made at a meeting, and has requested that I bring the matter formally to the attention of your honorable board.

"Plans are now in course of preparation which contemplate the installation of the unit system of heating and ventilation, and if the procedure being followed is not entirely satisfactory, I shall appreciate your advising me promptly of your wishes."

It was then moved and dopted that the unit system of heating and ventilating be adopted for all new school buildings to be hereafter erected.

Budgeting the Advertising Appropriation

The experience of the B. F. Sturtevant Co., Hyde Park, Boston, Mass., in budgeting its advertising appropriation in business papers, was the subject of an interesting and instructive talk by E. E. Leason, advertising manager, at the convention of the National Industrial Advertisers' Association, in Atlantic City, recently, and reported in *Advertising Forthightly* for July, 1923.

After several years of advertising in various business papers, without a definite plan, extending over a period of years, a complete and comprehensive study of the whole advertising situation was undertaken with the result that a definite plan for budgeting the appropriation was decided upon.

"Each department" he said "was given a certain percentage of the gross amount named by the board of directors at their annual meeting. Practical application of this system has been even more satisfactory than had been anticipated, because it not only held the expenditures within the limits of the budget, but it also gave each department manager a definite knowledge of the share of the appropriation which he was receiving.

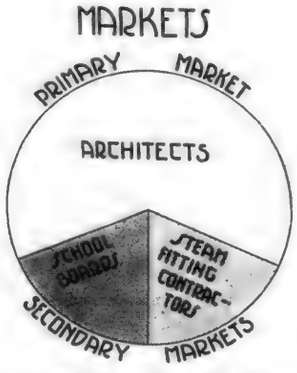


Exhibit A—Primary and Secondary Markets.

"Before expending the budget for any department the possible markets for its apparatus or products are divided into two divisions which we have called the primary and secondary markets."

Primary markets are illustrated by Exhibit A which accompanies this article. Architects as a group, he points out, have under consideration fairly constantly some sort of building and therefore form the primary market for heating and ventilating systems.

"We have found that there are similar primary markets for the products that each department is endeavoring to sell" he continued. "Our object, therefore, is to use these primary markets and, in other words, go after the sure business first.

"We do not always find our primary market in a single field; one that may be reached through a so-called 'vertical publication.' Our pneumatic-collecting and conveying department, for example, finds its work in a number of industries and by using the business paper for each of these industries the expense would be almost prohibitive. A 'horizontal publication' is, then, a very satisfactory alternative because through such a publication we are enabled to make a sweep across many industries and at the same time reach many readers who have real buying power.

1922 - 1923
PUBLICATION LIST
HEATING & VENTILATING DEPARTMENT

BUDGET		$10,000.00
PRODUCTION	$1500.00	8,500.00
AN ARCHITECTURAL PUBLICATION		
12 PAGES @ $100.00	1200.00	7,300.00
AN ENGINEERS PUBLICATION		
12 PAGES @ $50.00	600.00	6,700.00
A RAILROAD PUBLICATION		
12 PAGES @ $158.00 - $1986.00		
12 ⅛ - @ $158.00 - 075.00	2271.00	4,429.00
A MOVING PICTURE PUBLICATION		
12 PAGES @ $110.00	1320.00	3,109.00
A PAPER MILL PUBLIKATION		
12 PAGES @ $55.00	660.00	2,449.00
AN ELECTRICAL PUBLICATION		
13 PAGES @ $196.00	1898.00	551.00

Exhibit B—Relative Amounts for Advertising Expended by the Heating and Ventilating Department in Various Publications.

"Furthermore, a close check on the inquiries received from advertising in this class of media often uncovers a particularly active market. This would influence us in making a definite drive in a vertical publication reaching that market."

Secondary markets are represented by those groups which have some weight in the final decision as to whose product shall be purchased, Mr. Leason stated. While there is no definite way of determining just what percentage of influence any one of the markets included in the secondary group, will have, an idea of their relative importance is presented in Exhibit B.

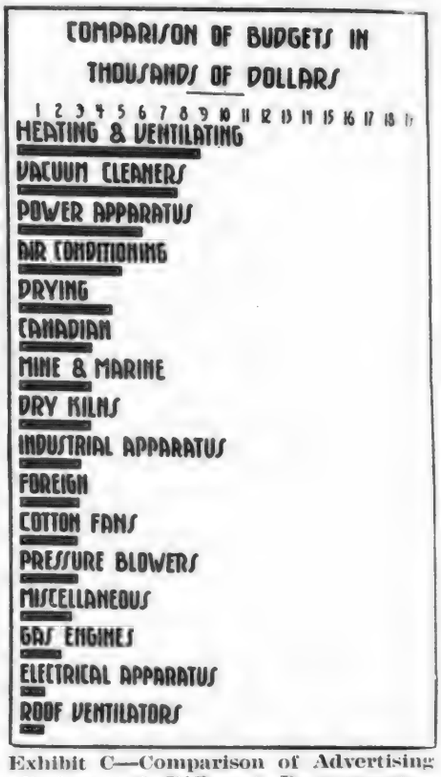


Exhibit C—Comparison of Advertising Budgets of Different Departments.

The school board, for instance, has some voice in the selection of a heating and ventilating system for a school building, as does also the steam fitting contractor. It is desirable, therefore, Mr. Leason stated, to educate these groups to the advantages of a particular system.

Exhibits B and C further illustrate the plan used by the Sturtevant Company. In the former is shown the relative amounts expended in different classes of publications, while the latter compares the budgets given the different departments.

"The percentage of the gross appropriation assigned to the several departments" Mr. Leason stated "is determined a great deal by the dollars and cents returned from sales of products, rather than on the basis of the size of orders, as indicated by units of equipment. For instance, a heating and ventilating system for a large public building would, in many cases, run up to as high as $30,000 or $40,000, and this for a single system. Whereas an order for 40 or 50 units of roof ventilators might not exceed $2,000. It is therefore the relative value of the product which really determines the amount of the appropriation any one department will receive. Further, this is also governed by the sales resistance which must be overcome in those industries to which the particular department caters.

"One exception to this policy is in the case of a new department which must be well advertised to place it on a sound selling basis. Under these circumstances, certain allowances must be made and the budget would be larger in order to give the 'baby' as good a start in life as possible."

After the mediums are selected the

company prepares a budget sheet for each department, as shown in Exhibit B, and contracts are made with the various mediums as far as the budget will allow. It has been found desirable, he stated, to maintain the budget sheet on what is termed a "diminishing total basis" which prevents exceeding the total amount of the budget.

Practical Advertising Suggestions for the Dealer.

Some practical suggestions of ways in which dealers should spend money for advertising are offered by G. C. Breidert, sales promotion manager for the Ilg Electric Ventilating Co., Chicago, Ill., in a recent discussion of this subject. As he pointed out, dealers' advertising problems are local and do not concern national advertising, except in the important matter of a tie-up with the manufacturer's program.

Locally, Mr. Breidert suggests, a dealer may use any or all of the following, which are enumerated more or less according to their importance:

Window displays, direct mail campaigns, local newspapers, bill boards, street cars, telephone directories, blotters and calendars, programs, picture slides, and stunts.

An attractive window display is one of the best means of obtaining good advertising with little or no expense. It furnishes a tie-up with national advertising and practically all of the material needed is furnished to the dealer free of charge. It is highly important that the dealer keep the window display attractive and change it often enough to catch the eye of the community at large.

"Direct Mail Advertising," states Mr. Breidert, "has always been considered one real way to deliver a message. Much argument can be stirred up on the subject. Nevertheless, the fact remains that even magazines, newspapers and trade journals use it to sell their service, which shows their respect for it. This does not indicate a superiority over other advertising mediums, but proves a certain value which applies generally."

It is much better, he states, to pick twenty names of actual possible users and circularize them five times at frequent intervals than it is to send out circulars to a hundred names picked at random. It is also conceded that personally-addressed and hand-signed letters make the best appeal, particularly when women are addressed.

Unlike newspaper advertising, direct-mail campaigns do not place the advertising in direct competition with the other advertisements. This is not to be construed, however, as an argument against newspaper advertising, which remains the cheapest method to reach a mass of people quickly.

Newspaper advertising, particularly if the dealer is located in the heart of the business district, is considered by Mr. Breidert a mighty good medium. Frequently readers will be attracted to the store out of curiosity and the visit may be turned into a sale. Then, too, newspaper advertising gives an impression of responsibility. Manufacturers supply many costly electrotypes to dealers, some of which unfortunately are wasted. Another advantage of newspaper space, it is pointed out, is in the wide territory served. Business is attracted not alone from the village or town where the dealer is located but from the rural districts and sometimes from neighboring towns.

A conservative newspaper campaign not only helps to advertise the particular products mentioned but also to a surprising degree advertises the store. Next to national magazines, newspapers enjoy the highest prestige and effectiveness.

Direct mail sent out by the manufactured and tied up with the dealer's newspaper advertising is very effective. While much more could be said of the relative merits of these two forms of advertising, Mr. Breidert states, experience has shown that there is less gamble in using direct mail and newspapers than with any other method.

Bill-board advertising is often used by dealers as a part of some manufacturer's program. Not enough of it has been done, Mr. Breidert says, to justify definite conclusions as to its value. It would seem, however, that only certain things can be effectively advertised by the bill boards. One is the fact that not all prospective customers can see the bill board, which usually is located along a highway, where it is seen only by travellers.

Bill boards, Mr. Breidert states, certainly have their place, especially for achieving national attention, but whether they are a good mediums for a local dealer to use is a big question, to say the least.

He believes street car advertising is a decidedly "up town" proposition: that is, dealers in the shopping districts can best enjoy results, because such advertising is read by people on the way to town, as a rule. It is easy to observe, he states, that it is mainly staple articles which are advertised through this medium. Specialties requiring explanation with every sale are never seen advertised in the street cars.

Telephone directory advertising, he declares, is admittedly overdone. As a result the small advertiser does not have a fair chance. Another point made by Mr. Breidert is that directory advertising does not attract attention or create desire, as do magazines, newspapers and direct-mail advertising. Therefore, he concludes, it should be used only with due consideration to the very limited claim it has to the term "advertising."

While millions of dollars are spent annually for blotters and calendars, Mr. Breidert is not convinced that this form of advertising has any great value. He states that at the time he wrote the article he had about fifty blotters on his desk, numerous letter openers, calendars, two rulers and a desk pad, and that he could not recall off-hand the name of a single one of the donors.

The unfortunate part of program advertising, he states, is that the little books invariably are thrown away immediately after the performance. Programs for dances and social events are no exceptions in his opinion. In them the retailer merely flashes his name as a good fellow helping the cause.

There was a time, he says, when picture slides were a novelty, but now a days the public is more or less annoyed when they are shown and very few theatres care to run them any more.

Trick performances and catchy stunts attract attention and are valuable when care is taken to have the performance embody something which makes the article a part of the act. Otherwise the crowd dwindles away at the end of the performance when effort is made to direct attention to the dealer's product.

Advertising by hand bills, old and abused as it is, still is a popular form of advertising. There is, however, great doubt as to the benefit because littering the front of a home with the bills frequently causes so much indignation that the literature is consigned to the furnace without a reading.

In conclusion, Mr. Breidert states that profitable advertising, after all, depends upon how judiciously, attractively and neatly it is done.

Are Office Buildings of the Future to be Windowless?

Office buildings of the near future are to be without windows, dependent entirely on artificial light and given proper ventilation by artificial means, engineers of the Nela Park Research Laboratories of the General Electric Company, at Cleveland, believe.

Preliminary findings show that daylight actually costs more to factories, museums, office buildings and public structures than electric illumination, the greatest cost in most cases being attributable to the ground areas given over to courts or light shafts.

Other reasons for the belief that windowless buildings are not far in the distance are set forth by the engineers as the cost of replacement of glass and general maintenance, loss of heat because of windows, and the tremendous cost incidental to the fading of decorations and cost of removing the large quantities of dirt and soot that blow in through the windows.

Dr. Matt Luckiesh, of the laboratory, states that excellent ventilation may be obtained free of all dirt and with purified air from artificial vents.

Central Station Heating Systems Urged for New England Cities.

A report favoring the district heating of homes by means of exhaust steam from power plants has been made by the Springfield Engineers' Union, following a survey of the power situation in New England. This survey parallels a study being made by the Power Investigating Committee of the Associated Industries. The full report includes a number of recommendations for power economies, the district heating idea being advanced as an important item in this connection by making heat a by-product in the manufacture of electricity. The engineers' figures show costs of municipal operation to be considerably below those of private operation.

The report of the Fuel Investigating Committee, appointed by the Associated Industries, will soon be ready for publication.

Pipe Sizes for Fuel Oil

In fuel oil piping, writes Allen F. Brewer, mechanical engineer of the Texas Company, in *Fuel Oil*, friction head is the essential point that must be considered. Friction head is regarded as the pressure in pounds per square inch that would normally be necessary in overcoming any frictional resistance which might occur between the interior surface of the pipe and the oil during the passage of the latter. Naturally, as the viscosity and Baume gravity of the oil increases there will be a certain increase in this frictional resistance. In other words, friction head will be increased.

Other factors which will affect friction head are: The length of the pipe and the degree of smoothness of its interior; the number of ells or other relatively sharp turns that the oil will have to pass during its flow; and the velocity at which the oil is flowing.

In the design and erection of a fuel-oil installation, continues Mr. Brewer, it will generally be possible to take into account only the nature of the piping and fittings. For example, unnecessary lengths should be reduced to a minimum; interior surfaces should be inspected to make sure that there are no obstructions, blisters, or burrs present; the pipe line should be laid out as nearly straight as possible, ells and other fittings being reduced in number wherever able; and gate valves should be used instead of globe valves in every case where valves are requisite.

"In order to determine the theoretically correct size of pipe which should be used in any system," continues Mr. Brewer, "the velocity of the oil and hourly consumption are important factors. It is advisable to regard the oil as flowing at normal maximum velocity with a corresponding maximum consumption, in order to insure a certain factor of safety. The velocity of the oil should, of course, be regarded as measured after the latter has left the heater and is in free passage to the burners. Inasmuch as the hourly consumption is the first unknown that must be arrived at before we can proceed to a determination of velocity, this is taken up as follows:

DETERMINING HOURLY CONSUMPTION

"Of course we will know the rated boiler horse power or total square feet of heating surface involved. Now, in an oil burning system of average efficiency an evaporation of 14 lbs. of water per pound of oil fired will be usual. At such a rate of evaporation the oil consumption will run on an average of approximately ½-gal. per minute per 1000 sq. ft. of heating surface. As a result of the above constants existing, it is a relatively simple matter to proceed with the calculation based on the total boiler heating surface involved.

"In order to simplify subsequent calculations we will regard this consumption as being 36 barrels per hour. Having decided upon our probable fuel oil consumption we can then proceed to work out the maximum normal velocity that will be required.

MAXIMUM NORMAL VELOCITY.

"This velocity of flow will be materially influenced by the viscosity of the oil. In turn operating viscosity will depend entirely upon the extent to which the oil is preheated in the oil heater. For the purpose of our problem we can assume a fair average figure for this viscosity in terms of degrees Engler. In marine practice it is generally customary to heat fuel oil until its Engler viscosity has been reduced to about 10°. In the stationary or industrial plant, however, especially where steam or air atomization is concerned, it will only be necessary to reduce the oil viscosity to approximately 20° Engler, under ordinary conditions. Since this problem is to apply to stationary service we will, therefore, assume 20° Engler as a constant for our viscosity, as it would usually be in the average plant. The following formula will apply:

$$\sqrt{\frac{\text{Velocity (in ft. per min.)}}{200{,}000}} = \text{Viscosity in Engler degrees}$$

"Where 200,000 has been determined as a constant. Thus,

$$\text{Velocity} = \sqrt{\frac{200{,}000}{20}}$$

equals 100 ft. per minute.

FIGURING DIAMETER OF OIL PIPING.

"Having decided upon the probable maximum velocity of the oil, the diameter of the oil piping which should be used can be caluculated according to the following formula:

Diameter of pipe =

$$4.1\sqrt{\frac{\text{required flow in barrels per hour}}{\text{oil velocity in feet per minute}}}$$

"Having assumed a maximum flow of oil of 36 barrels per hour, we find that,

Diameter of pipe =

$$4.1\sqrt{\frac{36}{100}}$$

$= 4.1 \times 0.6 = 2.46$ in.

"In other words, a 2½-in. pipe would be necessary to adequately handle the maximum oil consumption of the boilers when operating at peak load.

"It is usually considered advisable to install oil piping with as few dead ends as possible, and adhere to the principles of return circulation as much as we can. The purpose of this is, of course, to keep oil in constant flow all the time. Thus deposits in the piping will be eliminated to a large extent and heat will be conserved in the oil. This heat which is returned to the storage also serves to aid in preheating the fresh oil. In order to insure clean oil piping and reduce the extent of deposits it is advisable to blow such pipes through with a steam hose at frequent intervals. This is, of course, the more necessary according as heavier fuel oils are fired, which contain an appreciable percentage of foreign matter.

OIL DISTRIBUTION LEADS.

"There is one final size of piping that should also be mentioned; that is, the size of the oil distribution leads to the various burners, from the main oil header. As a rule, ⅜ to ½ in. will serve adequately, though, of course, such a size will depend upon the number of oil burners which are to be served. A safe rule to follow is: The total cumulative area of the piping leading to the burners should approximately be equal to the area of the main oil pipe."

Fuel Oil Burning in New York City

The introduction of fuel oil burning on a large scale in New York City has been the most recent and striking development in that industry.

Up to three years ago the use of oil as fuel was relatively unknown in New York City. For this there were several reasons, the first being that the oil companies had not developed local facilities for oil delivery such as existed in Boston, Providence, and other sea-board cities, and, second, the men in charge of the boiler plants were not convinced of the practicability of oil as a substitute for coal, both from the standpoint of economy and from the standpoint of reliability of supply. Also there was a great question in their minds as to the safety of burning oil as fuel from an insurance point of view.

As oil was not used as fuel in New York City, there were no municipal regulations existing on this subject. During the year 1919 local interest in oil burning for heating and power purposes, which had been under investigation by many of the larger plants, reached such a point that the city authorities undertook the preparation of a complete set of rules and regulations which would govern the use of oil burners and the installation of fuel-oil storage tanks. These rules were adopted and became effective December 1, 1919. At that time there were probably not more than three plants, all told, in New York City burning oil for heating and power purposes. Of course, oil was used for heat-treating and metallurgical plants.

It was at this period that I became interested in fuel-oil burning and made an investigation as to its practicability in New York City.

Having for four years been fire commissioner of New York City, and as such primarily concerned with the reduction and control of fire hazards, the first question which concerned me was as to the safety of oil as fuel from a fire protection point of view. Like most other New Yorkers, at that time I knew very little about fuel-oil burning, either as to this phase or any other. I, of course, officially had considerable to do with the adoption and enforcement of rules covering storage, use and transportation within the city of gasoline and other oils, but the storage of fuel-oil and

its use as fuel in buildings throughout the city was a new problem to me.

RESULT OF PRELIMINARY INQUIRY

I very quickly found that the burning of fuel-oil was very firmly established in many parts of the country, particularly in the large Pacific coast cities, in Boston, Providence, and elsewhere. Summing up briefly the result of my preliminary inquiry, I found:

1.—That the experts of the Fire Underwriters, a very able group of engineers who formulate the physical building standards followed by the insurance companies, had long since established a complete set of standards for oil burners and oil-burning installations, and that where these standards were followed the insurance people regarded the burning of fuel-oil as absolutely as safe in every respect as the burning of coal. Furthermore, where their standards were followed, the insurance on the building was in no wise affected.

2.—That many of the large cities had adopted similar standards of their own and that in cities like San Francisco, Boston, Providence, and many others, the man who regarded fuel-oil burning as doubtful or a questionable experiment, was placed in the same category as the hard shell, who, years ago, questioned the use of illuminating gas.

3.—That in the fuel-oil burning city of San Francisco when the big fire and earthquake of 1906 occurred, there were, to use the language of the Fire Marshal, "one hundred eighteen oil installations in the burned districts; there were no explosions, and when the ruins cooled off every one was found intact."

So much for the matter of safety.

ECONOMY AND EFFICIENCY OF FUEL-OIL

As to economy and efficiency, no extended investigation was required. Given the efficiency and operating cost of a plant on coal, it is easy to determine with reasonable accuracy the comparative results to be obtained from oil. On the basis of the price of the two fuels obtaining for the past few years, excepting possibly a few months of 1920 when, owing to the tanker shortage, the price of oil was unusually high, the comparison has uniformly been greatly to the advantage of oil. The larger the plant, the greater the advantage in favor of oil. In most plants, particularly the larger ones, we have found the saving in operation sufficient to amortize the cost of equipment in from one to two years' time. When the other advantages incidental to oil—freedom from coal and ashes, and increased plant efficiency—are taken into account, it is readily seen that a strong case is made out for oil versus coal.

The principal obstacle to the introduction of oil in New York City was the prejudice and lack of information concerning it. It required a long and earnest campaign of education to overcome these hurdles but great progress has been made, particularly within the past two years.

RECENT NOTABLE INSTALLATIONS

At the present time a large number of the largest buildings in New York City are burning fuel-oil for the generation of both heat and power. One of the first of the large plants to put in fuel-oil burning installation was that of the Hotel Ritz-Carlton, and another pioneer was the Singer Building on Broadway. More recent additions to the number are the great Metropolitan Life Building and quite recently the Equitable Building, the largest office building in the world, has contracted for the installation of fuel-oil burning equipment. Among department stores Wanamaker's, Macy's, Hearn's, and McCreery's, among others have put in fuel-oil burning equipment.

Many hotels in addition to the Ritz-Carlton, among them the Park Avenue, Claridge-Broadway, the Imperial, and the San Remo, have put in fuel-oil burning equipment. Many office buildings, including the Vincent Building, owned by the Astor Estate, the Knickerbocker Building, also owned by the Astor Estate, the Peoples Realty Building, 100 Williams Street, 1 & 3 South William Street, 43 Exchange Place and a great number of others are burning oil.

Several of the larger hospitals have gone over to oil, including Mt. Sinai, the great hospital establishment on Fifth Avenue, the new Beth Israel Hospital, which when completed will be the tallest hospital building in the world, and one of the most complete hospital plants. New York banks have also adopted fuel-oil burning equipment, the Excelsior Savings Bank being one of the most recent to be completed. The new building of the New York Times, the Federal Reserve Bank and others are also turning to oil.

These are merely examples and many others might be mentioned. The important point is that the period of scepticism is past, and fuel-oil burning is now an established industry in New York City. At least three oil companies have recognized this fact and are equipped to deliver fuel-oil by motor truck direct to buildings.

PROVISIONS OF LOCAL REQUIREMENTS REGARDING OIL STORAGE

All New York installations have to be made in accordance with the rules and regulations adopted by the city. These rules cover every feature of the equipment and are very complete. For example, no concrete tanks are allowed. All tanks must be of metal and every tank must be completely enclosed with a masonry enclosure at least 12 in. thick. There must be at least 12 in. clearance between the tank and the inside of the enclosure, leaving sufficient room for a person to move about within this space, and also affording sufficient capacity to contain the entire contents of the tank in case the tank should be ruptured. This enclosure must be vented to the outer air, not only to take care of any gases which might form, but a separate vent must be provided for the Fire Department connection so that the enclosure might be flooded in case of fire in the building. There are other safety requirements calling for shut-off devices, anti-syphon devices, etc.

If the fuel-oil burning movement continues to developed in New York as it has developed during the past two or three years, it will not be long before New York City can be numbered among the great fuel-oil burning cities. At the present time a sufficient number of the large and representative buildings of all classes have converted their plants to oil to justify the statement that fuel oil burning is firmly established in New York and is there to stay.—ROBERT ADAMSON in the *New York Building Superintendent.*

Action Taken in New York State to Reduce Industrial Accidents.

A comprehensive movement to cut down industrial accidents in New York State, now totaling about 300,000 each year with an average of 1300 fatalities, has been undertaken by capital and labor, at the earnest solicitation of Governor Alfred E. Smith and State Industrial Commissioner Bernard L. Shientag.

The first move in the campaign was a conference held recently at the State Labor Department's headquarters in New York City. At this meeting, which attracted several hundred men and women, many known nationally for their activities along commercial, industrial and welfare lines, it was decided to form and educational council to co-operate with the Labor Department in the campaign and to divide the State into six districts so that the most intensive sort of crusade may be carried on. Headquarters of these six districts will be in New York, Albany, Binghamton, Syracuse, Rochester and Buffalo.

It is proposed to designate one day of the year as "Industrial Safety Day" and the conference adopted a resolution to this effect. A Committee on Plan and Scope was appointed by Commissioner Shientag under the chairmanship of Arthur Williams, chairman of the Board of Directors of the New York Edison Company.

How Other People Get Ahead.

"How Other People Get Ahead" is the title of a pamphlet recently issued by the United States Government Saving System, Treasury Department, to present advantages of Treasury Savings Certificates. The foreword was written by Secretary of the Treasury A. W. Mellon. In it he urges thrift as one of the most important requisites for success. "A country of thrifty citizens makes a strong healthy nation," the book points out. "National thrift is a protection against war; an assurance of lower living costs; a guaranty of good employment. Why? Because the nation is but an aggregation of individuals, whose personal habits become national habits." Chapters include "The Key to Independence." "How to Avoid Bad Investments," Sound Investments" and "An Unusual Opportunity for Investment," with special reference to the U. S. Government Treasury Savings Certificates.

Types of Fuel-Oil Burners for Household Use

Previous articles in this series are: 1—Combustion Fuel-Oil Burners, Sept., 1922; 2—Kleen-Heet Oil-Burning System, Oct., 1922; 3—Ray Rotary Fuel-Oil Burners, Nov. 1923; 4—Victor Automatic Oil Burner, Dec., 1922; 5—Rotary Oil Burner, August, 1923.

VI.—The Boston Safety Automatic Oil Burner

The kind of fuel-oil used with the Boston burner is mostly a distillate from the oil refineries. There are several grades of fuel-oil between the standard fuel-oil used with the Boston burner and common kerosene. The Boston burner, it is stated, will work equally well with any of these grades of oil, and even kerosene can be used, if desired. The only oil that cannot be used with the Boston burner is the heavy 12 to 17 gravity oil. On this point the manufacturers state that the 12 to 17 gravity oil is not suited for domestic use, as it requires so much attention and pre-heating, and cannot be burned in automatic systems.

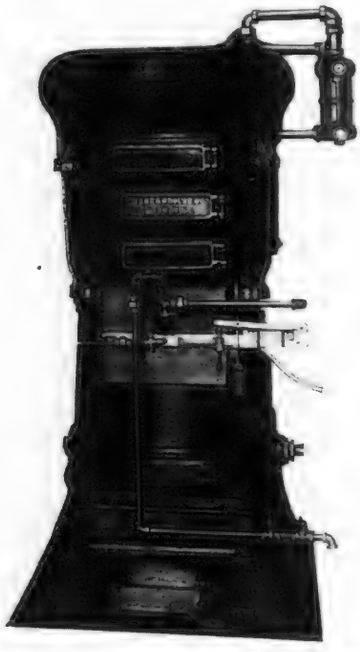


Fig. 1—Intallation of Boston Safety Automatic Oil Burner.

Ordinarily the Boston burner uses what is known as light fuel-oil, ranging from 26 to 32 gravity, with a flash point of from 140° to 190° F. It does not need pre-heating before use and burns automatically.

The oil spray is ignited by a small gas pilot placed under the tip of the burner which allows the burner to be started and stopped according to the temperature wanted in the building. The thermometer that starts and stops the burner is set so that the desired temperature may be maintained within a range of two degrees each way.

The general operation of the burner may be gained from the accompanying illustrations. A small rotary air compressor (Fig. 2) driven by a small electric motor, is used to pump the fuel-oil from the storage tank and to furnish a mixture of oil and air, as well as for atomizing the oil for burning. To install the equipment, the fire door on the boiler is removed and replaced by an asbestos door furnished with the system (Fig. 3). This door is fitted with a safety switch to prevent the discharge of unburned oil into the fire-box should the gas flame become extinguished.

Oil and air are separated in a separating tank, both oil and air being delivered together from the air compressor. If more oil is delivered into the separating tank than is consumed by the burner a surplus oil valve is provided to allow the extra oil to return to the storage tank.

The thermostat and motor (Fig. 4) for maintaining a uniform temperature and for automatically starting and stopping the burner, it is pointed out, are essential. The thermostat, with a handy thermometer, is usually placed in an open hall. This thermostat can be furnished with a clock device requiring one winding a week and which will automatically lower the temperature at night and raise it again in the morning. The thermostat acts in the usual way, operating a small motor device which starts and stops the oil burner. Additional regulation of the burner is secured by the steam pressure in a steam boiler and the temperature of the water or air in a water boiler or warm-air furnace, respectively. The manufacturer also furnishes a device when necessary which is attached to the oil pipe and is designed to reduce or increase the flame according to steam pressure, water or air temperature. With such a device applied, the burner is only stopped by the thermostat when the desired temperature has been reached.

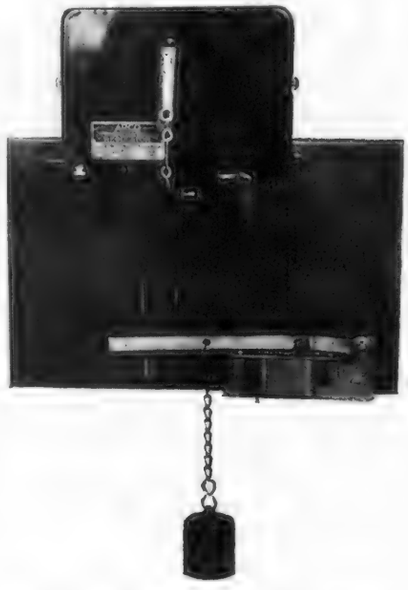


Fig. 4—Thermostat Control Arrangement.

Acting on the theory that no automatic oil burner is safe to use without a positive stopping device that will stop the burner and prevent oil from being discharged into the boiler should the pilot light be extinguished, the company furnishes a special safety device controlled by the pilot light (shown in Fig. 3). This device acts to break the electric circuit should the pilot light be out and, therefore, does not allow the burner to start when the thermostat calls for heat.

The fact that the device contains no sensitive electrical contact is mentioned as a point in its favor in that it cannot be affected by soot or carbon. The only electrical feature is the snap switch which directly controls the motor. The device consists of a metal rod of sufficient length, being expanded by having heat applied from the small gas pilot light located under the burner tip. The expansion of this rod binds a catch in a guide post so that a snap switch is closed by the heavy iron weight attached to the lever, and the electric circuit is closed. This switch, of course, is held in place,

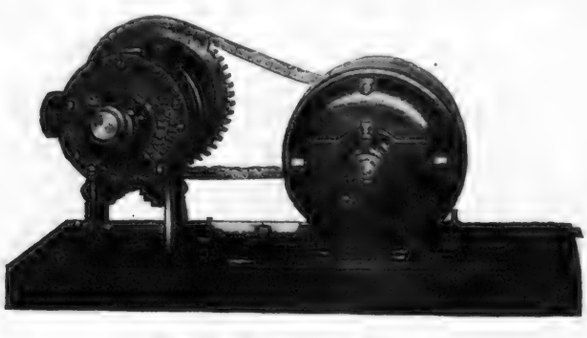


Fig. 2—Motor and Pump.

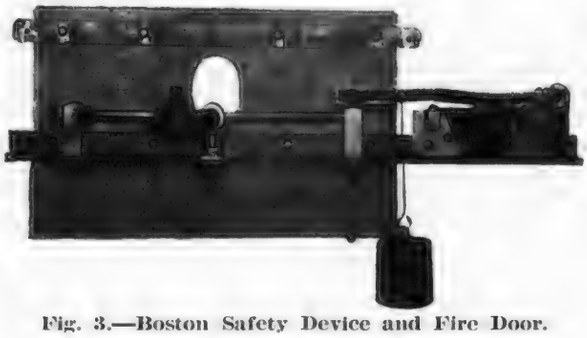


Fig. 3.—Boston Safety Device and Fire Door.

keeping the circuit closed as long as the gas pilot light is furinshing heat to keep the expansion rod expanded. Should the pilot light be extinguished, the rod contracts, allowing the catch to loosen in the guide post. The iron weight attached to the switch lever snaps back the switch, thereby breaking the circuit.

What is described as an exclusive device used only with the Boston oil burner is the oil and air separating tank (Fig. 5). The function of this tank is to eliminate the needle point valve, to regulate the oil flame and the oil pumps. These functions are all performed with one pump. The pump first acts to pick up the oil from the storage tank. Oil and air are discharged together into the separating tank which, as stated, is fitted with an automatic valve to allow the surplus oil pumped to flow back to the supply tank. Air pressure from 3 to 4 lbs. is furnished by the small compressor, as well as the oil supply. The air remains above the oil in the separating tank as the automatic valve only allows the tank to fill with oil to a depth of about 4 in. from the bottom. The air pressure then forces the oil to the burner and also supplies the air for atomizing the oil. This method of supplying oil to the burner and the burner construction itself, it is stated, allows for adjusting the burner to furnish the desired oil flame without having to use a needle point valve to control the amount of oil passing through the burner tip and the size of the fire.

The automizer furnished with this

Fig. 5—Oil and Air-Separating Tank.

system (Fig. 6) is placed through the opening in the asbestos fire door that contains the safety device.

No change is required in the boilers themselves, it is stated, to install the Boston oil burner, with the exception of the removal of the fire door and the placing of a few fire bricks laid loosely on the boiler grates for small boilers.

In the pump used to supply the burner

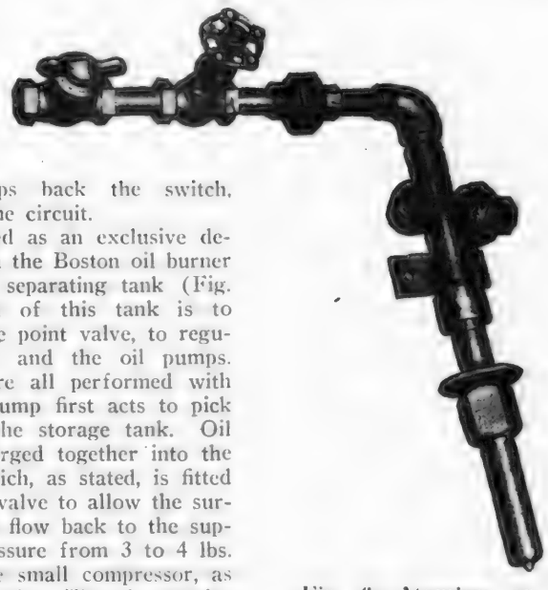


Fig. 6—Atomizer or Burner.

with air and oil, the air intake to the pump is retarded by a permanently set valve to provide for the formation of sufficient suction in the intake pipe to raise the oil from the storage tank. The oil passing through the pump serves to keep it cool and its lubricating qualities make it unnecessary to provide any separate oiling of the pump.

The Boston oil burned is manufactured by the Boston Vapor Heating Co., 24 Purchase St., Boston, Mass.

Plan for Part-Time Co-Operative Industrial Education Suggested by Pennsylvania's Bureau of Vocational Education.

The feasibility of providing equivalent, as distinguished from equal, educational opportunities for persons whom the all-day schools cannot hold or reach, is explained in a bulletin recently issued by the Bureau of Vocational Education, of the Pennsylvania State Department of Public Instruction at Harrisburg, Pa. The bulletin is entitled "Part-Time Co-Operative Industrial Education—Organization and Administration."

"An outstanding achievement of the twentieth century," the bulletin states "is the tremendous change and development that has taken place in the field of trades and industries. Changed industrial, economic and social conditions have been brought about by the industrial evolution, by the decline of the old forms of apprenticeship, and by the wide introduction of specialized factory methods of production. At present one of our greatest needs is that of providing adequate educational opportunities for those whose interests, capacities and ambitions lead toward industrial and trade work.

"Part-time co-operative industrial education has many advantages and it presents a practical means of broadening the educational opportunities for workers through the joint efforts and educational resources of industry and the public schools."

The plan, to be successful, it is pointed out, must be based on active and voluntary co-operation between employers and the State educational authorities, representing the child. Ordinarily it provides for fifty-fifty distribution of the learners' time as regards school work and work in industrial plants. Specifically the learner spends about one-half time at study or in school and the other half in productive work at industrial plants. A number of co-operative plans involving pupils of high school grade, now in operation in Pennsylvania, call for alternate periods of two weeks in school and in industry.

Part-time co-operative industrial education should give, it is stated, specific trade skills, specific trade and technical knowledge, and specific contributions to health and citizenship.

"It should aim" the bulletin continues, "to prepare individuals in part, or in entirety (depending upon the vocation involved) for effective participation in trade and industrial pursuits. This should be done, not in a narrow way, but with full realization that citizenship, health, happiness, and vocational efficiency are vitally inter-dependent, and with the consciousness that all forms of vocational education must be integral aspects of a unified and democratic program of education.

"These aims are to be achieved only by the full realization that close and detailed co-operation is involved between schools and industry, and that the combined educational resources of both agencies must be utilized in these important undertakings. The initiative rests with the schools rather than with industry, since the schools are especially charged with the responsibility for providing education to the public at large."

Sixteen different trades were taught in the Pennsylvania schools during the school year 1920-21. The Vocational Bureau is under the direction of L. H. Dennis. The assistant director, in charge of industrial education is F. T. Struck.

How a Building Conference Cut Construction Costs.

A saving of 250,000 on the construction, and the addition of a number of service features, in the new $15,000,000 32-story Straus Building, at Michigan Avenue and Jackson Street, Chicago, is the accomplishment of a conference over the plans of this building, held with the new Building Planning Service of the National Association of Building Owners and Managers, of which Earle Schultz, president of the national association, is chairman. The other members of this committee are: Clarence T. Coley, operating manager of the Equitable Building, New York; W. H. Ballard, president of the W. H. Ballard & Co., building managers, Boston; W. M. MacLachlan, manager of the Simon J. Murphy Co., Detroit, owners of the Penobscot, Marquette, Telegraph and Murphy Buildings, in that city; M. S. Halliday, assistant

vice-president of the Union Trust Co., Cleveland, whose new building is one of the largest office buildings in the world; Louis T. Clark, manager of the Wright & Callender Building Co., Los Angeles; Louis B. Ermeling, secretary of the national association; Edward Probst and R. F. Thompson, both of Graham, Anderson & Probst, architects of the new Straus Building; J. G. Morgan, vice-president of W. H. Ballard & Co.; Col. Gordon Strong, of the Republic Building, Chicago; and B. K. Read, technical adviser of Gordon Strong & Co. L. J. Sheridan, chairman of the building committee, and O. C. Foster, western head of the Straus engineering department, represented S. W. Straus & Company at the conference.

Building Conference of Building Planning Service of the National Association of Building Owners and Managers with Representatives of S. W. Straus and Company.

The idea of the conference was to formulate better building construction and operation. It is stated that the precedent set in this first commission of the committee will make possible like savings and better efficiency not only for office buildings, but for hotels, apartment houses, warehouses and industrial plants.

Among the savings effected as a result of the conference are: Elimination of sidewalk lights, elimination of locks on the inside office doors, elimination of exterior windows in elevator banks, elimination of one complete stack of toilets throughout the buildings, elimination of vacuum cleaning plant in favor of small portable machines, elimination of the setback in the court, which, at an expense of $50,000, made it possible to secure additional rentable area producing an annual income of approximately $25,000.

Summer Meeting of British Heating Engineers

A timely and instructive paper by J. Roger Preston on "The Cooling of Air" was a feature of the summer meeting of the (British) Institution of Heating and Ventilating Engineers, held at Folkestone, England, June 19. American heating engineers will also be interested in the talk given by W. Nelson Haden, past president of the institution, on his visit to America a year ago when he attended the annual meeting of the American Society of Heating and Ventilating Engineers, in Washington.

According to a summary of Mr. Haden's remarks, as reported in *The Plumber and Journal of Heating*, of London, Mr. Haden stated that he had the privilege of being present as a member and was very cordially welcomed. An interchange of ideas with his American confrères, he said, proved of enormous interest to him. The subject Americans ask most enlightenment upon, he said, concerned hot water work, their knowledge in that direction being less than is the case with steam installations.

Very good work, he felt, is being done in regard to research, though no help was forthcoming in the way of a government grant, but, even so, as the result of a recent appeal, a sum of $35,000 was promised by members and chairmen of chapters.

In connection with the testing of the efficiency of radiators at the Research Laboratory in Pittsburgh, Mr. Haden stated that the Research Laboratory agreed with him that an effort should be made to determine the best method of testing radiator efficiency and establish, after consultation, a definite system for both steam and water, which would assist materially in the comparison of results.

Mr. Haden stated that through the courtesy of the American Radiator Company, he had viewed the testing of one of the new boilers which that company is putting on the American market. These boilers, he said, are being made in much larger units, the largest being rated at 3,000,000 B.T.U. They are of substantial make and have double furnace fronts to allow of their being efficiently stoked.

In conclusion, Mr. Haden said the same problems were being considered on both sides of the Atlantic and it was to be hoped that some common methods of testing and rating would be arrived at which might be used throughout the British Empire and the United Sates.

Mr. Preston's paper proved a clear exposition of a rather involved subject and for that reason will no doubt prove of as much interest to American as to English readers. It will be presented in an early issue published in the official organ of the institution, *Domestic Engineering*, of London.

Reporting for the Research Committee, Edgar Herring stated that Bulletin No. 1, covering research work carried out at University College, would shortly be ready for distribution. The investigation on radiator emission tests is practically complete, but some radiators of a new pattern have been submitted and are now being tested. Full particulars of these tests will appear in Bulletin No. 3.

In order to expedite the institution's research work, the committee was instructed to take steps to secure the services of a whole-time investigator.

For the Fan Standardization Committee, Walter Yates reported that unforeseen difficulties had arisen which so far had proved insurmountable. The present stumbling block is connected with what is meant by static head or water gauge.

A new committee was appointed to take up the question of temperature guarantees.

It was announced that the autumn meeting of the institution will be held October 12, in London, to be followed by an inspection of the new County Hall which has a unique system of ventilation, as described in THE HEATING AND VENTILATING MAGAZINE for October, 1922.

The meeting concluded with a dinner at the Grand Hotel, Folkestone.

The New A. S. H. & V. E. Guide for 1923.

A work that goes far towards fulfilling the aims and ideals of its originators has been accomplished by the American Society of Heating and Ventilating Engineers in the A.S.H. & V.E. Guide for 1923 (Volume 2). The improvement over Volume 1 is reflected in every section. The text matter, for instance, which now comprises no less than 176 pages, has been completely revised and renewed, much of the material, including that on losses from buildings, steam heating, pipe sizes for steam heating, and the boiler, having been prepared by P. J. Dougherty, of Utica, N. Y. The catalogue section has also been enlarged and a list of products added which furnishes a convenient index of modern heating and ventilating equipment. One of the most useful features of the book is the list of members which will not be published in any other form.

No doubt, as future editions are compiled, ways will be found to condense the engineering data so that this material will be in more convenient form for use. In its present form, however, it embraces data for each step in the design of heating and ventilating work, from the con-

sideration of the required system, through the figuring of heat losses and the choice of the proper equipment.

As in the first edition, care has been taken to confine the catalogue data pages to precise information regarding manufacturers' products. Curiously enough, the only exception to this is in the announcement of the society's *Journal* which is described as "the only technical journal exclusively in the heating and ventilating field." Size 6 × 9 in. Pp. 399. Price $3.00. Published by the American Society of Heating and Ventilating Engineers, 29 West 39th Street, New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

St. Louis Chapter Launches Its Own Periodical.

News of the St. Louis Chapter of the American Society of Heating and Ventilating Engineers will be found hereafter in the chapter's periodical "The Radiator, (Red Hot)." The issue which is before us is No. 4, dated July 20, 1923. It contains the information that "The Radiator" is published monthly by the chapter under the editorial direction of E. R. Graves, assisted by First Vice-President Walter A. Klein. We take it that one of these gentlemen will have to assume the responsibility for the letter signed "Moon" dealing with "some of our local Bolsheviki," according to the writer, but dragging more than one St. Louis Chapterite into the limelight, if our knowledge of Yiddish, Italian and French does not fail us. An interesting article on "The Inconsistent Architect" is contributed by "Enalma," a pseudonym which looks different spelt the other way. After noting the way architects deplore the practice of builders usurping their field, the writer notes a correspondingly deplorable practice on the part of the architects in permitting the heating contractor to displace the heating engineer in designing their heating plants.

Correspondence

Atomization of Fuel Oil by Steam

Magazine.

EDITOR HEATING AND VENTILATING MAGAZINE:

Will you kindly advise me in the following matter?

I have a steam boiler in my house equipped with oil burners. There is a device on the market to mix two jets of steam with and against the oil flame. The steam comes from a cylinder above the flame and is generated by the flame. It is claimed that this gives more heat and that a lower grade of oil can be used. Do you think that the claims on these two points are justified? G. F. B.

Auburn, R. I.

So far as we know, no one has as yet perfected a small automatic steam generating device which will generate steam for atomizing oil without prohibitive attention and expense. Numerous attempts have been made along this line.

The use of steam as an atomizing agent is entirely practical and successful when steam is available for the purpose, but it does not lend itself readily for automatic control for the reasons stated and it has no value other than as a mechanical means for atomizing oil, since steam is actually the ashes from previous combustion of hydrogen. Hence there is no virtue in the use of steam other than its availability. Air, it may be added, is an equally good atomizer and assists combustion rather than retarding it.

Engineering Fees in New York.

EDITOR HEATING AND VENTILATING MAGAZINE:

If you will answer the following question, you will be conferring a great favor upon me and others. What is the average fee, in the City of New York, for the laying out of heating plans and the writing of specifications for an apartment house job, with two boilers and 8000 sq. ft. of direct radiation, not concealed. The plans and specifications to be made by a heating engineer on the fee system.

Detroit, Mich. I. W.

The average fee in New York on a percentage basis is from 4% to 5%. For a one-pipe system you can estimate about $2.00 per square foot of radiation and if it is a modulation job you can estimate from $2.75 to $3.00 per square foot.

Plants Should Be Equipped to Burn Either Coal or Oil.

One of the best ways for a building owner to protect himself against high coal prices and coal shortage, suggests John R. Collette, of the General Boilers Company, is to so equip the plant as to give him an opportunity of burning either coal or oil. In other words, by making use of a boiler equipped for oil-burning, the building owner can operate his heating plant on either coal or oil, depending upon which fuel is the more available and the cheaper.

New Smokeless Boiler Test

A boiler test recently completed by Richard Edwin Lee director of laboratories of Allegheny College, on the Monarch up-draft smokeless boiler, manufactured by the Wm. H. Page Boiler Company, shows some interesting figures, which are given herewith:

GENERAL DATA

Date of test	July 30, 1923.
Duration of test	Ten hours.
Kind of boiler	Monarch up-draft smokeless.
Kind of coal used	Pittsburgh.
Size of coal used	Lump.

DIMENSIONS

Type of boiler	Listed as No. 40-16.
Number of sections	16.
Rated capacity, sq. ft. radiation	9,000.
Grate surface, sq. ft.	23.13.
Total heating surface, sq. ft.	561.22.
Covering on boiler	Asbestos paste (1 in.).
Area of square chimney, sq. in.	1017.
Height of chimney, ft.	85.

CONDITIONS—AVERAGE TEMPERATURE, STEAM PRESSURES, ETC.

Average temperature outside air, deg. F.	78	
Average temperature of boiler room, deg. F.	89	
Average temperature of feed water, deg. F.	65	
Average temperature of flue gas, deg. F.	810	
Average steam pressure by gauge, lbs. sq. in.		2.6
Percentage of moisture in steam, Per Cent.—assumed		0.
Factor of correction for quality of steam		1.

TOTAL QUANTITIES INVOLVED

Total weight of coal fired, lbs.	3548	
Percentage of moisture in coal as fired		1.15
Total weight of dry coal, lbs.	3307	
Total ash, clinkers and residue (dry) lbs.	182	
Total combustible burned, lbs.	3325	
Percentage of ash and residue based on dry coal		5.2
Total weight of water fed to boilers, lbs.	39249	
Total weight of water evaporated, corrected for quality of steam, lbs.	39249	
Factor of evaporation		1.15
Total equivalent evaporation from and at 212 deg. F., lbs.	45136	

HOURLY QUANTITIES

Dry coal burned per hour, lbs.	350.7
Dry coal burned per hour per square feet of grate surface, lbs.	15.01
Water evaporated per hour, corrected for quality of steam, lbs.	3924
Equivalent water evaporation per hour from and at 212 deg. F., lbs.	4513
Ditto per square foot of water heating surface, lbs.	8.04

CAPACITY

Evaporation per hour from and at 212 deg. F., lbs.	4513	
Rated capacity per hour from and at 212 deg. F., lbs.	2250	
Percentage of rated capacity developed		200.6
Water fed as per pound of coal as fired, lbs.	11.06	
Water evaporated per pound of dry coal, lbs.	11.16	
Equivalent evaporation from and at 212 deg. F. per pound of coal as fired, lbs.	12.72	
Ditto in terms of dry coal, lbs.	12.86	
Equivalent evaporation from and at 212 deg. F. per pound of combustible, lbs.	13.60	

EFFICIENCY

Calorific value of 1 lb. of coal (dry) (Determined by bomb calorimeter), B. T. U.	14736	
Calorific value of 1 lb. of combustible, B. T. U.	15734	
Efficiency of boiler and furnace, per cent.		83.2
Efficiency of same based on combustible, per cent.		83.8

DATA RELATIVE TO SMOKE-CONSUMING PROPERTIES

Average amount of CO_2 in flue gas, per cent.	12.1
Draft at damper, approximate, in.	0.3
Percentage of smoke observed during the test—Only small quantities at time of feeding coal—did not persist longer than one minute.	

Situation Requires Caution

Speeding Up of Collections and Clearing of Distributing Channels is Urged

Especially Prepared for the HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn Schmidt

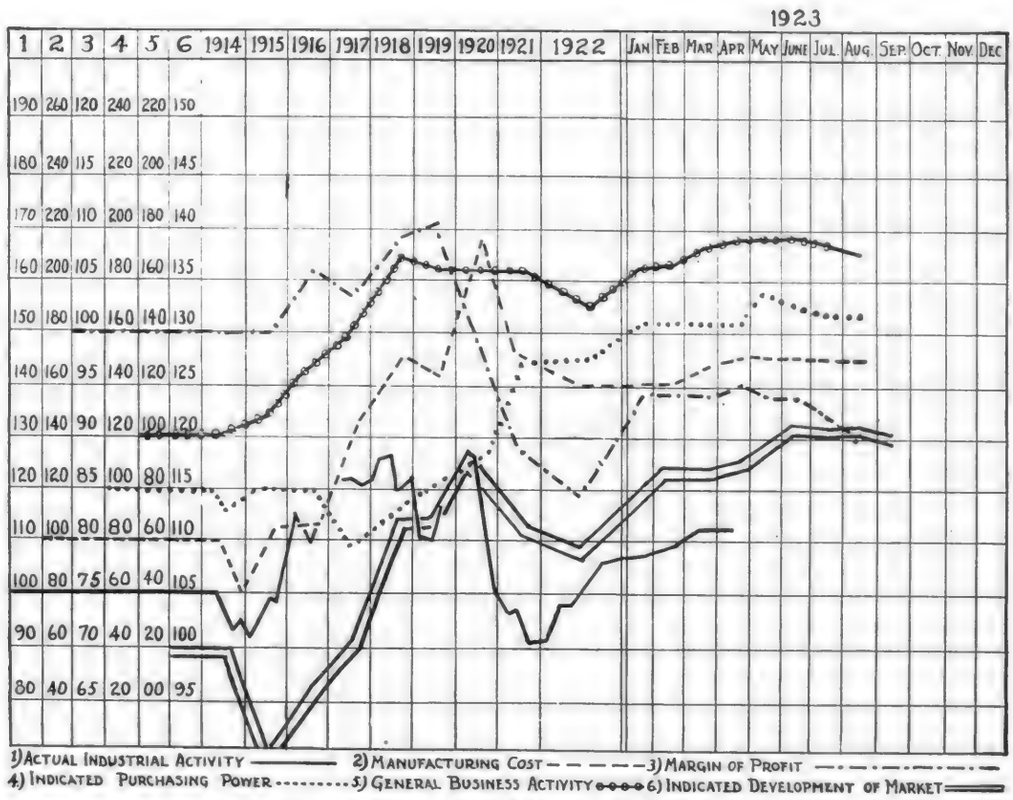
There have appeared on the economic firmament signs which require the urgent attention of the industrial and business community. For the first time in many months there is noticeable a downward movement of some of the factors governing economic prosperity. Whether these signs point to a permanent weakening of the structure can not be found at the present state of the development. But whatever may be the case it behooves the careful business man and executive to watch his steps more closely and to administer such stimulants to his enterprise as may be most suitable to secure it against any emergency.

It has been the practice of these reports to judge the symptoms of prosperity conservatively. So we caution now again against undue pessimism. There was no reason for excessive rejoicing about our most recent period of plenty because we only received what was due to us, and there is no reason now to view with anxiety a situation which, after all, may not be anything else but a temporary slowing down of the economic activities of the nation. Business progresses in waves of varying strength. But these waves no not start at one defined point and end abruptly at the same place and time. On the contrary, they start at many points and at different intervals, moving along on their course, some being nothing else but small ripples, others gaining considerable strength. If, as it happens sometimes, two strong waves meet at the same place and time, they combine their force and unite to a wave of considerable power and altitude. But during the same time other minor waves run also, and it is their fate which ultimately determines the duration and force of the whole economic movement.

So at the present time we need not worry about the decline of the volume of business in any one specific field as long as the broad market itself does not begin to show signs of a general decline. For this, however, there is no indication just now.

Studying the situation on its real merits there would be full justification for declaring it nothing but the usual midsummer seasonal decline. But there is one feature to it which demands making a reservation. This is the fact that the decline, small as it is, follows a rather quick rise and has been preceded by rather unsatisfactory news about the earning power of our agricultural population. Experience shows that rapid increases of commercial activity are often followed by similar rapid declines. This theory, however, will not hold good just now, considering the comparatively limited forward movement of the present economic ascent. But of more importance seems to be the unsatisfactory condition of the farmers' market which cannot but influence buying from that quarter. A tendency to discount in advance any danger from such a partially hidden source often causes a receding movement like that during August, and it may easily extend into September.

Allowing for such a possibility it is of interest to enquire more fully into the ability of the market to deal with the situation. Reports of saving banks, life insurance companies, and benevolent association show that considerable amounts of money have been invested in these institutions during the last year, accounting in this manner for the apparent discrepancy



Analysis of Business Conditions at End of August.

between the national purchasing power and the actual purchase turnover as represented by the sale of merchandise. The level of purchasing power has not been lowered during the last two months and retains its very satisfactory position. This means that the market is amply supported still by the buyer, a condition which will continue to act upon sales for a considerable period to come.

Manufacturers apparently have tried to throw the consumer another bait by keeping prices on as low a level as they can afford under the circumstances. But while prices still show a tendency to lower levels in most of the so-called consumers' merchandise, here has not taken place a similar reduction in manufacturing cost. This, on the contrary, has just escaped another increase with the result that all price reductions have come from the pockets of the manufacturer in the form of a somewhat lowered profit.

Manufacturers will do well to give this feature of the situation special attention. Industrial operation can be carried on to the national benefit only when profits are sufficiently large to compensate the manufacturer for his labor and to enable him to keep up such a commercial organization as to market his product to his best advantage. If profits decline persistently, as appears to be the case just now, a weakening must result of the economic structure, leading to inefficient operation and in turn to a stringency of operating capital. This latter appears to have happened at this very time and complaints about slow collections have become exceedingly numerous while, therefore, there is probably no real trouble ahead of us and while with some certainty a full recovery with a further improvement may be promised for autumn there is some reason for careful management.

Two recommendations are made. The first is that manufacturers, jobbers, and dealers do everything in their power to facilitate the flow of monetary payments by close adherence to credit terms, so as to secure a greater availability of cash, relieving banks of the necessity of locking up large sums in purely commercial loans. The second is the use of advertising to stimulate and broaden the flow of merchandise from the jobber to the retailer and consumer in an endeavor to clear the channels of trade to prevent a sudden clogging of the main arteries of the market.

Legal Decisions

Change of Contract Rates—Free Heat to City Held a Discrimination

The Montana Supreme Court holds, City of Billings *v.* Public Service Commission, 214 Pac. 608, that the statute creating the commission conferred upon it the power to change the rates, tolls and charges in public utility contracts, such as contracts for hot water for heating purposes, notwithstanding the fact that they existed prior to the passage of the statute. And the city was held not entitled to a preference where its inhabitants would not be, since it is a consumer like its inhabitants who patronize the utility. Where a city receives its heat free, the utility's other patrons foot the bill. It is held that this is a discrimination which the commission was right to stop. The company concerned was the Billings Utility Company.

Total Revenues of Steam and Electrical Departments Considered in Fixing Rates

Holding, as the result of an investigation of the rates, charges, etc. of an electrical and heating company, the Midwest Power Company, that the company's present steam-heating rate is not unreasonable, the North Dakota Board of Railroad Commissioners, because of the fact that the physical property of the electric utility is so interwoven with that of the steam utility, does not deem it advisable to attempt to separate the two properties. The testimony before the board showed that considerable exhaust steam is sold for steam-heating purposes, and the commission therefore determined the total operating revenues and expenses of both the steam and electrical departments in fixing rates.

The company was allowed an annual depreciation reserve of 4% of the depreciable property and an annual return of 8%.

Time for Filing Claims of Subcontractors—Architect's Decision as to Completion of Work

A subcontractor on a municipal contract for the erection of a schoolhouse sued the City of Boston and others to have applied on its claim under the contract any cash or security provided by the city. Various other subcontractors intervened as claimants.

The city had made final payment to the general contractor and had no other security than the contractor's bond furnished by a surety company, one of the defendants. The surety company claimed that the work was completed on August 8, 1919, and that all the claimants had lost their rights because each filed his sworn claim more than 60 days thereafter, as required by the Massachusetts statute.

The contract provided that the date when completion had taken place should be decided by the architect. The architect decided that completion had taken place on the date mentioned; but it appeared that on that date there were still some items in the heating, lighting and plumbing contracts which the architect erroneously claimed he did not have to inspect and did not inspect, but relied on the supervision of such work and approval thereof by the city supervisors as reported to him by the chief clerk of works.

The Supreme Judicial Court of Massachusetts holds, Hurley v. City of Boston, 138 N. E. 838, that the finding of the architect cannot be impeached merely because he was careless in his inspection, or mistaken in his conclusion. His judgment may have been wrong, and a more careful examination might have disclosed his error. As long as he acts fairly and in good faith, is not the victim of the fraud of others, and exercises his own honest judgment, the finding, or decision, is binding.

But the master to whom the case had been referred found that the architect had not made any inspection of the electrical, heating, ventilating, and plumbing work on the building, although such inspection was part of his duty, and that he thus failed to exercise any judgment on passing on this work. The court holds that "the parties were entitled to the best judgment of the architect, based on his own inspection of the progress of the work. They were to be bound by his decision and not by the decision of the supervisors employed by the city. He could, of course, rely on his assistants acting under his directions, in determining the date when the contract was finished," or make his decision "on such evidence as he might choose to receive." The determination of the architect, however, may be avoided where he has been misled, and so far misapprehended the case that he failed to exercise his judgment upon it. "The heating and other work which were a part of the contract, should have been passed upon by him before deciding the date of completion of the entire work. The decision was not the decision of the architect; it was not such a decision as would bind the parties." Judgment was therefore ordered for the plaintiff and the suit was held entitled to interest from intervening claimants.

The subcontractor who brought the the filing of his bill, and the intervening subcontractors from the date of their intervention, except that those who had made demand before that date were entitled to interest from date of demand.

Deaths

J. Eugene Lynch, a former partner in the heating and ventilating contracting firm of Lynch & Woodward, Boston, Mass., died July 10 at his home in Newton, Mass. He was 64 years old. Mr. Lynch began his career in Chicago, being associated with the S. A. Pope Company, of that city. He was sent to Boston by that company to supervise the heating and ventilating installation in the Boston Court House. He remained in the Hub City where he formed a partnership with James W. Woodward. This partnership continued until last July, when both partners retired, the business being continued under the name of Lynch & Woodward, Inc., by two former employees, Edwin A. Dusossoit and Edgar Shaw.

J. M. Daly, treasurer of the heating and ventilating contracting firm of M. J. Daly & Sons, Inc., Waterbury, Conn., died July 12.

National Trade Extension Bureau

How to Plan a Heat Regulation Sales Campaign

Some useful ideas for bringing home to the American public the value and economy of heat control in their homes and of promoting sales of heat-regulating equipment are contained in the T. E. B. *Monthly Service Bulletin,* which is staging a heat regulation campaign during the month of September.

The first essential, it is stated, is to decide how much time and money you are going to devote to the purpose of putting over an effective campaign.

THINGS TO DO

Under "Things To Do," the *Bulletin* suggests the following:

Every campaign will vary with the individual facilities of the individual firm. However, here are some things that should not be overlooked in any campaign which it is desired to have prove successful. Be certain that you have an automatic heat regulation appliance of the make which you sell, set up and operating in your store so that you can give practical, actual demonstrations of its working. It would give added advertising value to this demonstration if it were in your window, or otherwise plainly in sight of the passer-by.

Be sure that you have, during the month of September, at least two effective window displays of automatic heat regulation.

LIST YOUR PROSPECTS

Well in advance of the first of your campaign, be sure that an accurate list is made up of the names of every known prospect for automatic heat regulation in your locality. Be sure that during the month, each one of these prospects receives at least three sales letters, including appropriate advertising literature, at intervals of a week or ten days apart. Be sure that every prospect and every inquiry is promptly and carefully followed up.

Arrange for newspaper advertising and for advertising slides to be displayed on the screen of your local picture theater, exploiting your service in installing automatic heat regulation.

Above all, be sure that you yourself, and every member of your business organization, is properly posted to make a good selling talk, at any opportunity, on the subject of automatic heat regulation.

FOLLOW THROUGH

Finally, don't let your efforts on this, or any other campaign, die out; merely because the end of the month is reached. Selling efforts of this kind are always best and most profitable when made continuous.

Use the month of September, this time, for all special activities particularly identified with a campaign on automatic heat regulation. Let the week of the 16th to the 22nd, inclusive, be made a period for highly concentrated effort to close up every possible bit of this sort of business which remains open. But, also make such arrangements as will be certain to cause the prompt following up, continually, of every possible prospect for automatic heat regulation.

PROFITS IN FOLLOW UP

The value to any business of any special drive is not to be measured by the business actually brought in during the time of the drive, any more than it is to be measured by the opportunities for later business which are developed during the drive. These opportunities for later business are the real profit of any drive, and therefore should be most carefully followed up.

A number of window displays are suggested by the bureau. In one, the following directions are given:

For the background, use strips of orange and black crepe paper about 2 in. wide twisted and hung as seen in photograph. The large thermostat is made of wall board, shaped and painted to represent the make of thermostat you handle. An 18-in. Scotch gauge glass, ½ in. in diameter, is used to represent the glass in the thermometer. Purchase a hollow rubber ball about 2 in. in diameter and 4 ft. of rubber hose. Cut a hole in the rubber ball to fit over lower end of glass tube. Now connect one end of hose to glass by running same through back of thermostat, up through the rubber ball and into glass tube. Be sure that the tube fits the glass snug enough to prevent liquid from leaking out.

Place three pedestals as shown in photograph; drape some sort of yellow cloth over same. Now place thermostat securely fastened on center pedestal as pictured. Place an oscillating electric fan directly in back of thermostat, on floor of window so that it will be out of sight from the street. Attach loose end of hose to a cord, passed through a small pulley fastened to top of rear side of thermostat; and down to another pulley fastened to the thermostat at the same height as the guard of electric fan. Now attach the loose end of the cord to the guard of fan.

Pour bright red liquid of some sort, into hose connected with glass so that it will stand at 70° on thermometer scale. When the fan is in motion, it will raise and lower the loose end of hose, thereby causing the liquid to rise and fall in glass, suggesting rise and fall of temperature. When the hose and fan are properly placed and adjusted the liquid should not rise above 70° nor fall very far below 60°. On each small pedestal place a thermostat. Other heat regulating or controlling devices, air valves, etc., could also be shown, in connection with appropriate cards.

The cards in this window read as follows: "AUTOMATIC HEAT REGULATION SAVES FUEL BOTH DAY AND NIGHT." The two small ones read, "BELOW 60° WHILE ASLEEP." "70° DURING WAKING HOURS." These cards with thermostat as explained can be secured for you by T. E. B. for $5.00. Cards alone $1.00, F. O. B. Evansville, Ind.

Window Posters for the Heating and Plumbing Industries.

A high-grade uniform window display poster advertising service is announced by the National Trade Extension Bureau for the benefit of heating contractors and plumbers. The service will consist of 52 posters, 19 in. x 25 in., printed in two or more colors, and bearing high-class art work, accompanied by short, crisp, sales copy. With each service there will be furnished an attractive and substantial display frame. This, it is stated, will provide a weekly change of advertising messages, suitably prepared and equipped for show window or store display use.

Operation of the Minneapolis Heat Regulator.

In connection with the campaign staged by the National Trade Extension Bureau for the wider use of heat regulating systems, special interest attaches to the adaptability of the Minneapolis heat regulator, manufactured by the Minneapolis Heat Regulator Co., Minneapolis, Minn. As will be noted from the accompanying il-

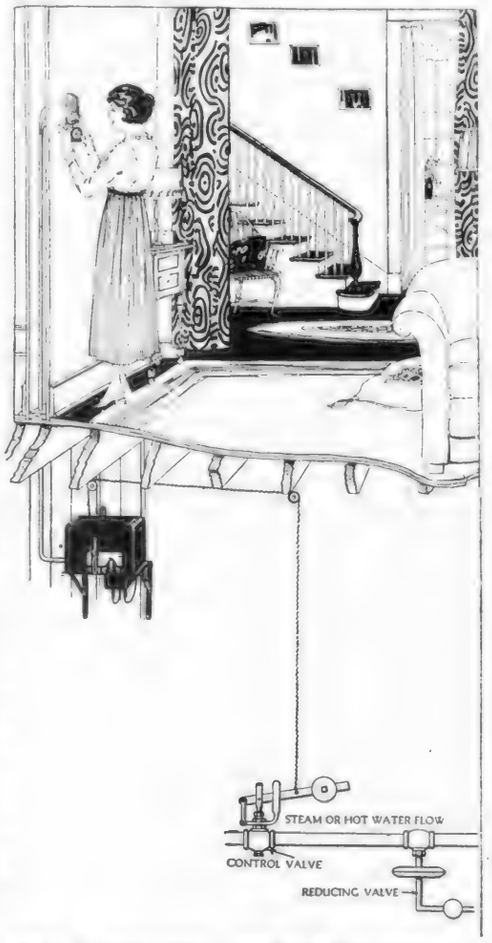


Fig. 1—Intallation of Heat Regulating System in a Home Supplied with Central Station Heat.

lustrations, the complete equipment includes an eight-day duplex thermostat, an electric motor, with the necessary wiring and chain attachments. For ordinary use where an individual heater is used, the chains from the motor lead to the dampers of the heater.

The diagram (Fig. 1) shows an installation in a home using central station heat. In that case the motor, operated by

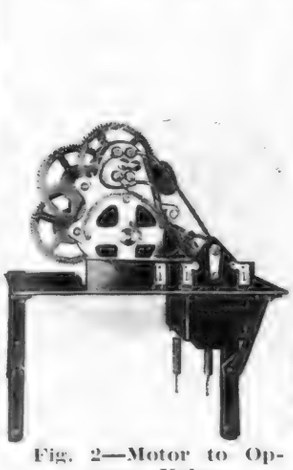


Fig. 2—Motor to Operate Valve.

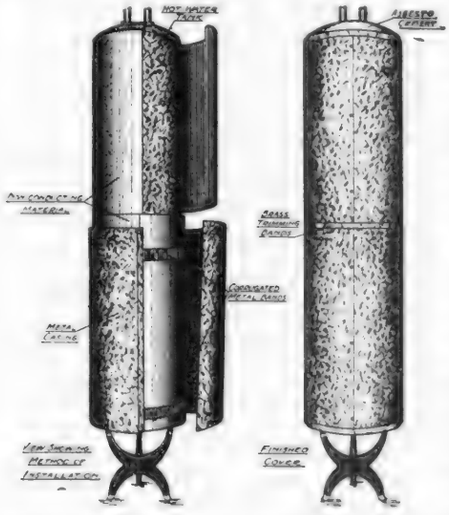
Fig. 3—Eight-Day Duplex Thermostat.

the thermostat, opens and closes the supply valve according to the variations in the room temperature. The only change required in the heating system is the installation of a quick opening valve which is furnished in various sizes, according to the size of the supply line.

The motor which operates this valve operates directly from 110-volt A.C. or D.C. from the lighting circuit.

A Cover for Hot Water Tanks.

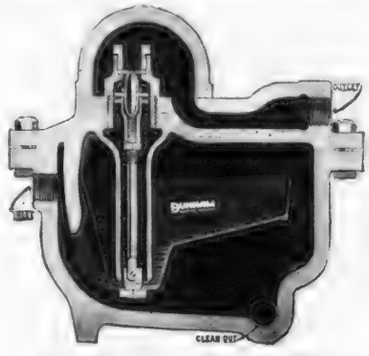
An asbestos metal air-space cover for hot water tanks and heaters is an interesting product which has been recently placed on the market by Spicer's Asbestos, Ltd., Vancouver, B. C. Its general arrangement and adaptability may be noted from the accompanying illustrations. As will be noted, the covering consists of, first, a layer of the non-conducting material, which is held in place by corrugated metal bands. Outside of this is the metal casing which is held in place by brass trimming bands. Among the users of this cover is the British Columbia Electric Co., Ltd., which has purchased over 300 of them. The manufacturer is now seeking sales agencies for the cover.



Spicer's Asbestos Cover for Hot Water Tanks.

New Trade Publications

Dunham Type No. 80 Bucket Trap (made in Canada) is featured in Bulletin No. 113, issued by the C. A. Dunham Co., Ltd., Toronto, Canada. It is designed for high-pressure steam service. It is an intermittent flow trap, using the open bucket dump principle for operation. The manufacturers state that it is particularly adapted for draining high-pressure power station and distributing lines, and for removal of condensate from steam separators, laundry equipment, heaters, vulcanizers, dry-kilns, and where steam pressures of 50 lbs. or more are used. Claim is made for the trap that the destructive effect of steam, wire-drawing the seat, is reduced to a minimum by the "quick closing" accomplished through the shape of the bucket. The proportion and shape of the bucket is such that when it begins to

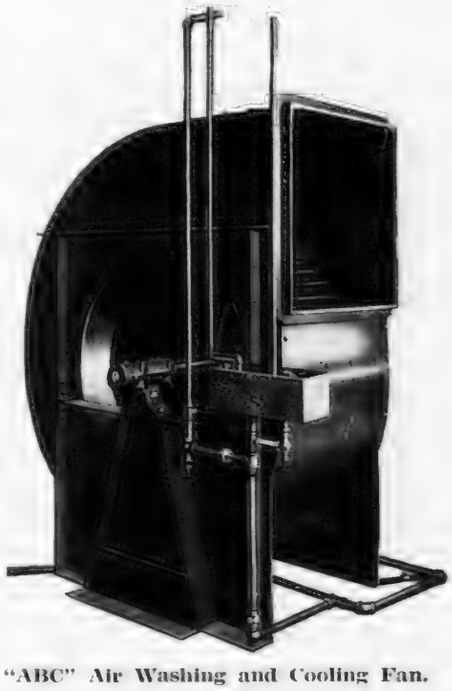


New Dunham Bucket Trap

rise, all water inside the bucket is shifted toward the hinge, filling the water seal, and the movement of the bucket upward is accelerated, producing, it is claimed, a quick, positive, forceful action and reducing the wear on valve and seal. The accompanying figure shows a section of the Type 80 bucket trap, in closed position. The inlet opening for condensate is in the side of the body and the discharge opening in the cover. In operation, as the body fills with condensate the bucket rises and through the movement of valve stem closes the valve. The accumulation of condensate overflows into the bucket until it fills and over-balances. The bucket falls quickly, opening the valve and discharging water from the bucket and trap body through discharge tube, until only a small amount remains, sufficient to seal the discharge tube, then the closing operation is repeated. The bulletin is fully illustrated and contains also specifications and list prices. Size 8½ x 11. Pp. 8.

Hoppes Water Meters, exhaust heads and exhaust steam feed-water heaters and purifiers, are described in three folders recently published by the Hoppes Manufacturing Co., Springfield, O. An exclusive feature of the Hoppes water meter, it is claimed, is the interchangeable recorder head, making it possible to place it either above or below the cabinet. Construction, appearance and the guarantee are three reasons urged for consideration of the trade in the folder describing the Hoppes standard cast-iron exhaust head. The Hoppes exhaust steam feed-heater and purifier is especially adapted, it is stated, to handling water containing a large amount of scale-forming ingredients. It removes oil from exhaust steam, heats water to 210°F. and is built in capacities ranging from 50 to 50,000 H. P. Sizes 3½ x 6¼. Pp. 4.

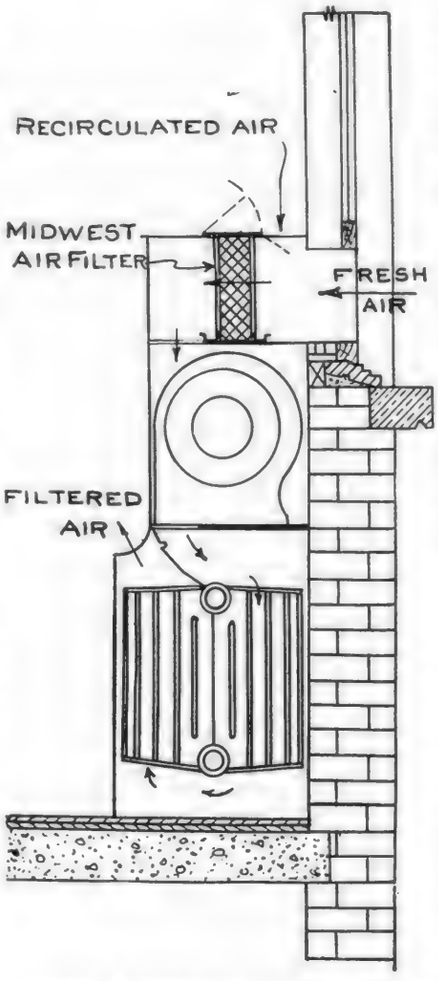
American Blower "Sirocco" Products, including fans, exhausters, air washers, blowers and engines, are presented in a new general catalog, issued by the American Blower Co., Detroit, Mich. The purpose of the catalogue is to show in a general way the various types of equipment the company makes and to give sufficient date to enable those receiving it to arrange for the preliminaries of estimating work. Detailed bulletins on all the products, it is stated, are obtainable on request. Considerable space is devoted to dimension tables covering various types of the Sirocco fan, including single and double-inlet, left or right-hand, top or bottom, horizontal or vertical discharge. Condensed capacity tables are included for all sizes. The company's high-speed fans for forced draft, high-speed ventilating fans, ABC steel-plate fans, various types of steel-plate exhaust fans, pressure blowers and exhausters, and the



"ABC" Air Washing and Cooling Fan.

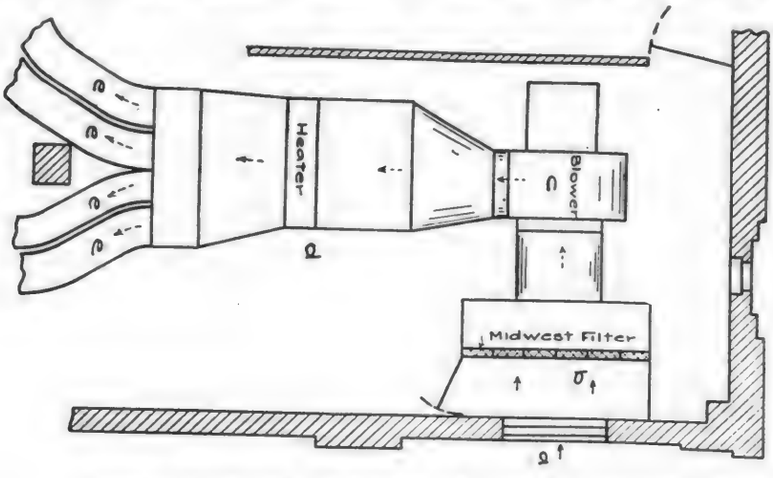
Ventura line of ventilating fans, are other products described and pictured in the catalogue. The reversible Ventura disc ventilating fan is featured as especially adaptable for removing odors from household kitchens. The catalogue contains data on the company's mine fans, ABC pipe-coil heater, Vento cast-iron heaters, portable heating units, direct-fired heaters, Detroit steam traps, Sirocco circulators for warm-air furnaces air washers, air washing and cooling fans, and fan-testing instruments, including the ABC pitot tube and the ABC inclined manometer. Many of the illustrations are installation photographs, and there are also comprehensive performance tables for the various products. Size 9 x 11 in. Pp. 110.

DUST PROBLEMS AND THEIR SOLUTION is the subject of a copyrighted booklet issued by the Midwest Air Filters, Inc., New York, and addressed particularly to architects, engineers and plant executives. Disclaiming any pretensions toward having a cure for all "dust ills," the company solicits inquiries and presents in a convincing way, through text and illustrations, the line of Midwest filter processes and apparatus. In general, it is stated filtration problems may be divided into five main groups, as follows: 1, filtration of air used in cooling or operating machinery and equipment in order to protect such equipment from dirt and dust; 2, to maintain a high state of purity in manufactured products; 3, for general ventilating purposes; 4, application of air or gas filter apparatus in manufacturing processes, and 5, application of air or gas filter apparatus to problems of abating public nuisance, due to escaping materials in powdered form from manufacturing plants Midwest air filters, it is stated, are based on the general principles (a) that the forward progress of the dust carried in the air or gas currents is arrested by some kind of structure with the combined properties of a screen and a baffle, allowing the air to pass through, but holding dust particles back, and (b) that such structure, acting both as a screen and baffle, be especially prepared so as to better catch and hold the dust particles, by making the surface rough or sticky, or both. Advantages claimed for Midwest unit air filters are their high flexibility, lending



Typical Installation of Midwest Air Filter in Unit Ventilator.

themselves to convenient arrangements in almost any available space, the fact that they may be placed in or near the outside walls of a building entirely within the building, or on the outside, and the ease with which they can be installed. In ventilating problems, it is claimed, the Midwest unit air filters constitute efficient air washers or dust and bacteria binders. Special attention is called to their wide use in ventilating installations. They are described as capable of removing all of the dust in the air to within 0.15 grains per 1000 cu. ft., and 90% to 100% of the bacteria. The book contains numerous installation pictures and figures, one of the latter depicting a typical arrangement of ventilating equipment in the basement or on the top floor of a school, store or office building. Another displays a possible combination of a Midwest filter with heating equipment on the so-called unit heating and ventilating principle. The concluding pages are devoted to standard specifications for each type of Midwest air filter. Size 8½ x 11. Pp. 52.



Typical Installation of Midwest Air Filter in Ventilating System.

VALVE WORLD for June 1923, issued by Crane Co., Chicago, Ill., contains the sixth issue of its supplement, "The Crane Business Survey." General business, collections and retail trade are classed as "fair" in New York City, with general conditions up state quite satisfactory. Building permits declined some and trouble was being experienced with strikes in the city. New England conditions are reported good with little unemployment. The survey reports business conditions in the Southern Zone very satisfactory with the exception of Memphis where business is "only fair." Conditions in the Northwest or Northern Zone are reported as satisfactory and improving. The Central Zone is in excellent shape, the survey reports. Business is brisk and collections satisfactory in the Western Zone, according to the survey, which reports Canadian business is "backward." The summary states that the country is "basically sound," that the upward tendency has been checked and business is moving within safer limits. An interesting feature of the June issue is an illustrated article by H. L. Delander on the company's new Chicago exhibit rooms.

VENTILATION OF AUDITORIUMS with Knowles Mushroom fresh-air diffusers, which are featured as being especially adaptable for use in connection with the indirect or mechanical systems of heating and ventilation in theatres, schools, churches and public buildings, is discussed in a new booklet issued by the Knowles Mushroom Ventilator Co. 202-204 Franklin St., New York. After describing the operation of the Knowles air diffuser, the circular takes up the different types, including the notch type which is notable, among other things, for its rigidity as the top cannot be moved by the feet; the aisle hood air deflector, to be placed under the aisle seats only and arranged to throw the fresh air out into the aisles in one direction; and the Camelback air diffuser, providing for two-way delivery at the ends and designed to operate at a minimum of cost and friction loss. Other types are the "single damper," "double damper," "bottom damper" and "lever lock" air diffusers. The company also shows a "no regulation" air-controlling head and a ceiling air-controlling head. The concluding pages of the booklet are taken up with sample specification forms for Knowles mushrooms and air diffusers, some newly-compiled data on their adaptability to all types of auditorium ventilation, and rules for determining the number of units required in a given building. A lengthy list of buildings is included in which Knowles units are installed. Size 8½ x ½ in. Pp. 8.

"An ARCO Water Regulator on every job"

STEAM

HOT WATER

VAPOR

Suburban Heating Company

6810 WINDSOR AVENUE
BERWYN, ILL.

RIVERSIDE 168-W

BERWYN 797-J

December 13th. 1922.

BERWYN 535

American Radiator Company,
Chicago. Illinois

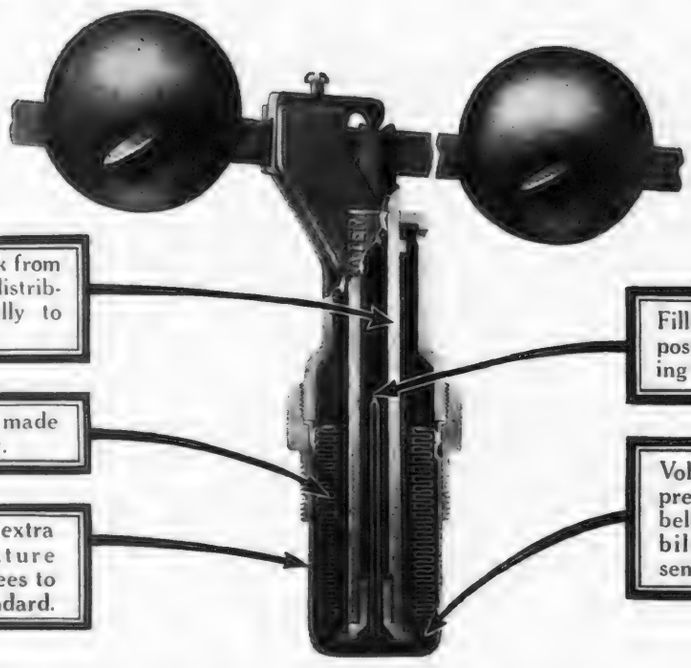
Gentlemen:-

Having installed quite a number of No 800 ARCO WATER REGULATORS which have in each case given us a satisfied customer. it is with pleasure that we recommend them, to any person desirous of being relieved of a great share of the individual attention required by the boiler drafts.

We make a practice of figuring a HOT WATER REGULATOR on every job out of this office.

Very truly yours,
SUBURBAN HEATING COMPANY

Lee E. McGuire



Stem transfers work from bottom of bellows distributing travel equally to each fold.

One piece bellows made in our own factory.

Design provides extra long temperature range—100 degrees to 220 degrees standard.

Filling tube provides positive method of sealing liquid chamber.

Volatile liquid develops pressure on outside of bellows. Gives durability, accuracy and sensitiveness.

You can get ARCO Water Regulator from your jobber or from our nearest branch

AMERICAN RADIATOR COMPANY

IDEAL Boilers and AMERICAN Radiators for every heating need

1807 Elmwood Avenue Dept. S 46 Buffalo, N.Y.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

PORTABLE UNIT VENTILATORS.

The Univent.

A distinguishing feature of the Univent, manufactured by the Herman Nelson Corporation, Moline, Ill., is the Univent double radiator which is designed to provide the utmost radiating surface in the limited space provided. Another advantage of the double radiator is that it makes possible the use of a mixing damper without any reduction in space, so that temperature control may be obtained, either by hand or automatically, without interfering with the ventilation.

When fresh air is to be used, it is admitted into the upper compartment of the Univent through a window or opening provided in the wall. In this upper compartment is a small electric motor which operates two centrifugal fans. These fans drive the incoming air down the tempering half of the radiator, over a dust-eliminating device located in the bottom compartment, then up through the heating side of the radiator and out through the front of the unit towards the ceiling. The fresh warm air, it is stated, leaves the Univent almost vertically at a velocity oppromixating 1000 ft. per minute, depending upon conditions.

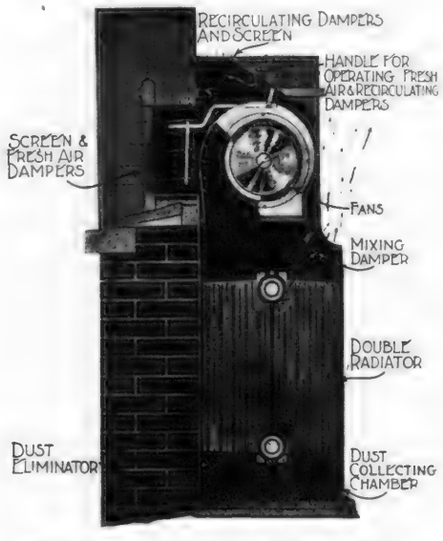


Fig. 1—Operation of the Univent.

As the fresh air strikes the ceiling its velocity is depended upon to cause its deflection and diffusion throughout the room. The system provides for a vent register or flue, generally placed near the floor on the opposite side of the room, depending upon certain local conditions. The used air passes to the outside of the building, either directly through the flue or through a corridor or attic.

As shown in Fig. 1 a mixing damper is provided above the radiator for mixing the cold and warm air as it leaves the Univent, making it convenient to control the temperature of the air either by hand or automatically. The Univent is also arranged so that the air in the room may be recirculated. This is accomplished by turning the recirculating damper which closes the outdoor inlet and opens the recirculating inlet on top of the unit.

To obtain noiseless operation all the blades of the fans are stamped from a single sheet of copper, aluminum or other non-corroding metal. They are then formed around a pair of rims to which they are brazed. The whole fan, including blades and rims, is made practically in one piece. In addition, the suspension plate, to which the

(Continued on Data Sheet No. 6-E).

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

PORTABLE UNIT VENTILATORS.

The Univent.

(Continued from Data Sheet No. 6-D).

Univent motor and fans are attached, is independently suspended on the radiator, so that it does not in any way come in contact with the steel cabinet.

Special attention is called by the manufacturer to the location of the vent outlets. Under average conditions one outlet is considered sufficient, but at times several outlets will be found necessary. Vent outlets that are too large, it is found, sometimes interfere with good diffusion. The practice of equipping vent outlets with heat coils or other means for extracting the air is not recommended.

The Univent is regularly furnished with direct-current motors to provide noiseless operation. When alternating current only is available it is recommended that a small motor generator be used to convert the alternating current to direct current.

The Univent is also fitted with a dust eliminator and, if desired, a vapor humidifier can be added. The reservoir at the bottom of the cabinet acts as a dust-collecting chamber. It can be kept filled with water or glycerine to accomplish this purpose.

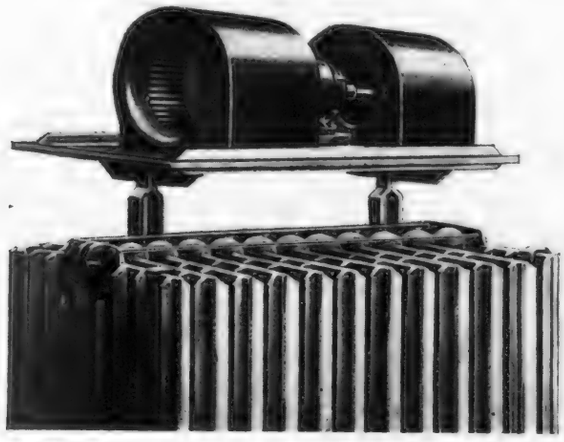


Fig. 2.—Method of Suspending Motor and Fans to Prevent Vibration.

The exact power consumption of the Univents varies with the capacities, but for the wiring calculations and the determination of motor generation sizes, the following table may be used, as it allows a safe working margin:

300 series, 1.5 amperes.
400 series, 2.0 amperes.
500 series, 2.25 amperes.

As stated, the air temperature is controlled by the mixing damper. This damper is arranged to by-pass air from the upper plenum chamber to the cabinet outlet. The arrangement is such that the cold outside air is driven down into the back half of the radiator and tempered before being by-passed.

The figures above the black lines in the accompanying tables are intended to indicate capacities which will insure good diffusion. The first section represents low, the second section, medium, and the third section, high outlet velocity machines.

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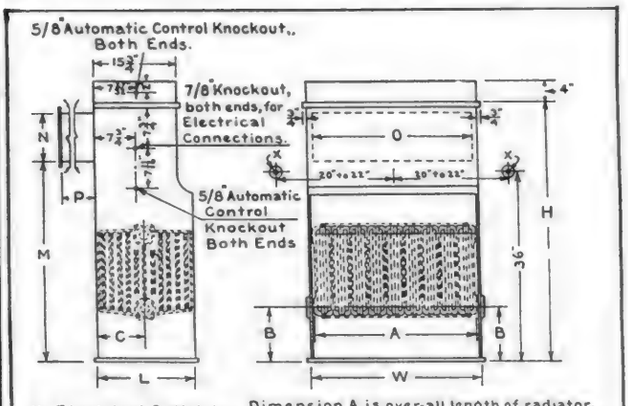
(Continued on Data Sheet No. 6-F).

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

PORTABLE UNIT VENTILATORS.

The Univent.

(Continued from Data Sheet No. 6-E).



X = Electrical Outlet, to be provided at one side of machine, left side preferred.

Dimension A is over-all length of radiator.

Dimension B is distance from bottom of Cabinet to center of radiator tappings

SERIES	RADIATOR A	B	C	Steam	Return	CABINET H	W	L	INTAKE M	N	O	P
301	30 3/8	14"	9 1/8"	1 1/2"	1"	49 1/16	32 1/4	18 1/4	37 15/16	9 1/8	30 1/8	Intake
302	29 3/8	"	"	"	"	"	"	"	"	"	"	furnished
303	31 3/4	"	"	"	"	"	"	"	"	"	"	12" long at
304	30 3/4	11 3/4"	"	"	"	"	"	"	"	"	"	P. can be
305	29 3/4	"	"	"	"	"	"	"	"	"	"	Cut to
306	31 3/4	"	"	"	"	"	"	"	"	"	"	not less
307	30 7/8	9 1/2"	"	"	"	"	"	"	"	"	"	than 6"
308	32 3/8	"	"	"	"	"	"	"	"	"	"	long on
309	31 3/4	"	"	"	"	"	"	"	"	"	"	1eg.
310	30 3/4	14"										
311	29 3/4	"										
312	31 3/4	"										
313	30 3/4	11 3/4"										
314	29 3/4	"										
315	31 3/4	"										
316	30 3/4	9 1/2"										
317	29 3/4	"										
318	31 3/4	"										
319	30 3/4	14"										
320	32 3/4	"										
321	31 3/4	"										
322	30 3/4	11 3/4"										
323	32 3/4	"										
324	31 3/4	"										
325	30 3/4	9 1/2"										
326	32 3/4	"										
327	31 3/4	"										

Serial Number	Cubic Feet of Air Per Min.	Capacity in Equivalent Square Feet Direct Steam Radiation and surplus surface for heating, at various entering air temperatures													
		+30°		+10°		0°		-10°		-15°		-20°		-30°	
		Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.
301	600	142	61	157	36	165	23	173	11	177	4	181	0		
304	600	160	79	177	51	186	45	195	33	199	27	204	21	212	10
302	600	164	83	182	61	191	49	200	38	205	32	209	26	218	15
307	600	177	96	197	74	206	64	216	53	221	48	225	42	235	32
305	600	184	104	204	83	214	73	224	63	229	58	234	52	244	42
303	600	192	113	213	91	223	81	233	71	239	67	244	61	254	51
308	600	203	122	225	103	236	94	247	85	252	80	258	75	269	66
306	600	214	132	236	115	248	106	260	97	266	93	271	89	283	80
309	600	232	152	258	136	270	129	282	121	289	117	295	113	308	105
310	750	170	69	188	36	197	20	206	4	211	0				
313	750	192	91	213	61	223	46	233	31	239	24	244	16	254	0
311	750	195	94	216	64	226	49	236	34	242	27	247	20	258	5
316	750	212	111	235	83	246	70	257	55	263	49	269	42	280	28
314	750	219	118	242	91	254	77	266	64	272	57	278	50	290	37
312	750	227	127	252	100	264	88	276	74	282	68	289	62	301	48
317	750	243	141	269	116	282	104	295	89	302	88	308	80	322	68
315	750	253	152	280	129	294	117	308	106	314	100	322	94	335	83
318	750	277	176	307	156	322	145	337	135	344	130	352	125	367	115
319	900	195	73	216	34	226	14	236	0						
322	900	220	99	244	63	256	44	268	25	274	16	280	7		
320	900	224	102	248	65	260	47	272	28	278	20	284	10	296	0
325	900	245	123	272	89	285	72	298	55	305	46	312	38	324	21
323	900	252	130	278	96	292	80	306	63	312	55	320	46	332	30
321	900	259	138	287	105	301	89	315	73	322	64	329	56	343	40
326	900	279	157	309	126	324	110	339	95	347	88	354	80	369	65
324	900	291	170	322	137	338	126	354	111	362	104	370	96	385	82
327	900	319	198	354	172	371	159	388	146	397	140	405	133	422	119

(Concluded on Data Sheet No. 6-G.)

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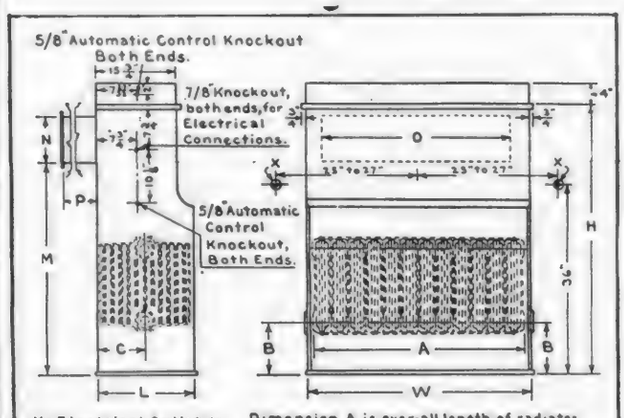
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

PORTABLE UNIT VENTILATORS.

The Univent.



X = Electrical Outlet, to be provided at one side of machine, left side preferred.

Dimension A is over-all length of radiator.
Dimension B is distance from bottom of Cabinet to center of radiator tappings.

SERIES	RADIATOR A	B	C	Steam	Return	CABINET H	W	L	INTAKE M	N	O	P
401	41 1/8"	10 1/8"	9 1/8"	2"	1 1/4"	51 1/8"	42 3/8"	18 3/4"	40 5/8"	9 1/8"	36 1/8"	Intake furnished 12" long or P can be cut to not less than 6" long on
402	41 5/8"	"	"	"	"	"	"	"	"	"	"	
403	42"	"	"	"	"	"	"	"	"	"	"	
404	41 1/4"	13 1/8"	"	"	"	"	"	"	"	"	"	
405	41 5/8"	"	"	"	"	"	"	"	"	"	"	
406	42"	"	"	"	"	"	"	"	"	"	"	
407	41 5/8"	10"	"	"	"	"	"	"	"	"	"	
408	41 5/8"	"	"	"	"	"	"	"	"	"	"	
409	42"	"	"	"	"	"	"	"	"	"	"	
410	41 5/8"	14 1/8"	"	"	"	"	"	"	"	"	"	
411	41 5/8"	"	"	"	"	"	"	"	"	"	"	
412	42"	"	"	"	"	"	"	"	"	"	"	
413	41 1/2"	18 1/8"	"	"	"	"	"	"	"	"	"	
414	41 5/8"	"	"	"	"	"	"	"	"	"	"	
415	42"	"	"	"	"	"	"	"	"	"	"	
416	41 1/2"	10"	"	"	"	"	"	"	"	"	"	
417	41 5/8"	"	"	"	"	"	"	"	"	"	"	
418	42"	"	"	"	"	"	"	"	"	"	"	
419	41 1/2"	14 1/8"	"	"	"	"	"	"	"	"	"	
420	41 5/8"	"	"	"	"	"	"	"	"	"	"	
421	42"	"	"	"	"	"	"	"	"	"	"	
422	41 1/2"	18 1/8"	"	"	"	"	"	"	"	"	"	
423	41 5/8"	"	"	"	"	"	"	"	"	"	"	
424	42"	"	"	"	"	"	"	"	"	"	"	
425	41 1/2"	10"	"	"	"	"	"	"	"	"	"	
426	41 5/8"	"	"	"	"	"	"	"	"	"	"	
427	42"	"	"	"	"	"	"	"	"	"	"	

Serial Number	Cubic Feet of Air Per Min.	Capacity in Equivalent Square Feet Direct Steam Radiation and surplus surface for heating, at various entering air temperatures													
		+30°		+10°		0°		-10°		-15°		-20°		-30°	
		Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.	Tot. Cap.	Htg. Cap.
401	900	302	85	224	48	235	31	246	12	251	3				
404	900	290	103	257	79	267	62	279	46	285	37	292	29	304	12
402	900	236	112	262	86	274	70	287	53	293	45	300	37	313	21
407	900	254	127	281	103	295	90	308	74	315	67	322	59	336	44
405	900	264	140	293	118	308	103	322	88	328	81	336	73	350	58
403	900	271	154	300	125	316	111	330	96	337	89	344	82	359	67
408	900	291	174	322	148	338	134	353	103	361	103	369	103	384	93
406	900	301	185	334	158	350	146	366	133	374	126	383	120	399	103
409	900	329	212	364	180	382	176	400	166	408	161	418	155	435	144
410	1050	226	90	251	47	263	25	278	3						
413	1050	258	120	286	81	300	61	314	41	320	32	328	21	341	1
411	1050	265	129	294	90	308	70	322	50	329	40	337	31	352	11
416	1050	286	149	317	112	332	94	348	75	345	66	363	57	379	39
414	1050	298	162	330	120	346	108	362	90	370	81	378	72	396	54
412	1050	304	168	336	132	354	115	370	98	378	89	387	80	402	62
417	1050	328	192	364	159	382	140	400	125	408	118	417	111	435	94
415	1050	338	202	375	170	394	156	412	140	421	131	430	120	448	108
418	1050	372	236	411	207	432	193	452	179	462	172	472	165	492	120
419	1200	251	96	278	45	292	26	-							
422	1200	285	129	315	81	330	59	346	34	353	23	361	11		
420	1200	293	137	324	91	340	68	356	45	364	33	372	21	387	0
425	1200	316	160	350	116	366	94	385	72	392	61	401	51	418	28
423	1200	329	173	364	131	383	110	400	89	409	79	418	67	437	47
421	1200	335	179	371	137	390	117	407	96	416	86	426	75	444	55
426	1200	363	207	402	168	422	137	441	130	451	120	460	110	480	91
424	1200	378	219	415	191	435	164	455	137	465	135	476	125	497	107
427	1200	411	255	454	221	477	204	498	188	510	137	522	137	543	137

(Concluded on Data Sheet No. 6-H.)

Copies of this Data Sheet, printed separately, 5 cents each.

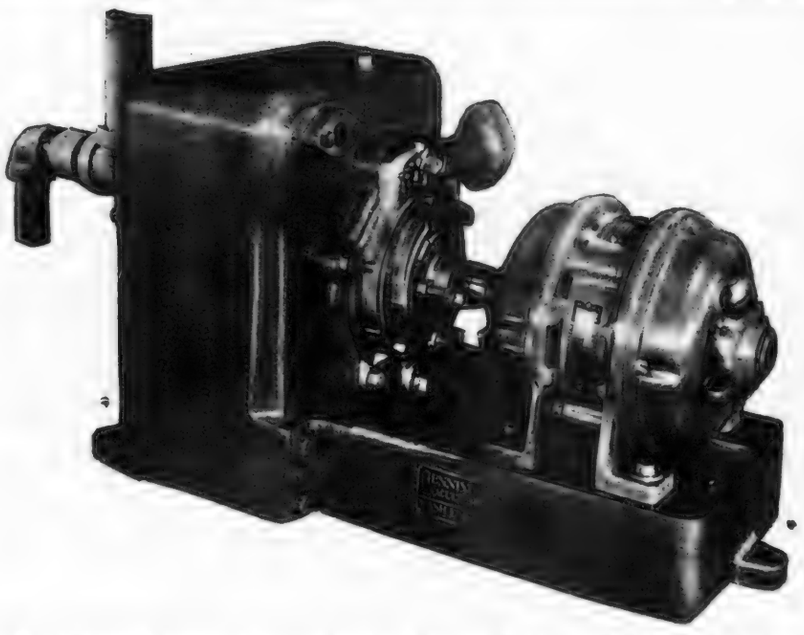
TRADE MARK REG.

Typical
Jennings
INSTALLATIONS
A Series
INDIANAPOLIS

National City Bank Building
Fletcher American Bank Building
Reserve Loan Life Insurance Company
Palace Theatre
J. F. Wild Bank
Duckwall Realty Company — 2 pumps
H. C. Stutz Motor Company
Guarantee Building
Murat Temple
Indiana Central College
Lincoln Hotel
Severin Hotel
S. M. Bixbe Company
Allison Experimental Company
Central Avenue M. E. Church
City Hall, Indianapolis
Adams Rogers Company
Walter A. Ristow Greenhouse
St. Peter & Paul School
Highland Golf Club Plaza Garage
Millikan Apartments
Dollman Apartments
Lumley Apartments
Climax Machinery
Parcel Post Bldg.
Brennecke Building
Thompson Restaurant
Central States Envelope Company

The Jennings Hytor

Return Line Vacuum Heating Pump
Heart of the Heating System



Size "M" Jennings Hytor Vacuum Heating Pump with integral tank. This pump has ample capacity for 5,000 square feet of equivalent direct radiation, requiring only ¾ horse power motor at 1800 R. P. M. when delivering from a vacuum of 10" of mercury against 10 pounds gauge pressure at the pump.

No matter how well designed a Return Line Heating system may be, its satisfactory operation is largely dependent upon the proper functioning of the Vacuum Return Line Pump. The Jennings pump has proven on thousands of installations that it possesses the features necessary for proper operation under the most extreme conditions.

Jennings Return Line pumps are simple in construction, containing but one moving element, running with a clearance in the casing. They are simple to install and operate, they require little floor space and are noiseless in operation. Their use results in a marked economy in coal. Many users hold that they more than pay for themselves in this respect alone. A Jennings pump on your system means quick heat in the most isolated radiators at a minimum steam pressure.

Now is the time to consider equipment for replacements and new installations for next season. Our Engineering Department is at all times ready to render service on problems relating to heating.

NASH ENGINEERING CO.
SO. NORWALK, CONN., U. S. A.

Trade and Miscellaneous Notes

Coming Events.

September 17-22, 1923—National Exposition of Chemical Industries, at the Grand Central Palace, New York.

October 15-19, 1923—Fifth Annual Convention of the American Gas Association, at Atlantic City, N. J. Headquarters on the Steel Pier.

October 20-28, 1923—Safety, Health and Sanitation Exhibition at 106th Infantry Armory, Brooklyn, N. Y.

December 12-16, 1923—Annual Convention of the National Association of Practical Refrigerating Engineers, in Memphis, Tenn.

Miscellaneous Notes.

Louis F. Pearson, chairman of the Beeston Foundry Co., Ltd., of Beeston, England, and a past president of the (British) Institution of Heating and Ventilating Engineers, has been knighted by the King in recognition of his public and political services in Nottinghamshire during and since the close of the World War. Sir Louis was identified with some of the large operations in connection with the manufacture of munitions and also served on the Engineering Standardization Sub-Committee. Since the war he has acted as chairman of the Nottingham Women's Hospital and the Nottingham and Notts Convalescent Homes.

United States Civil Service Commission announces an open competitive examination for superintendent of construction, the duties to consist of complete charge of labor, materials and construction on such building projects as are undertaken by the Veterans' Bureau; the estimation of labor and materials required, their efficient distribution, and the maintenance of complete and accurate accounts thereof. Receipt of applications will close September 25. Entrance salaries will range from $3,000 to $3,600 a year. Competitors will not be required to report for examination at any place, but will be rated on their education, experience and fitness. Full information is obtainable from the United States Civil Service Commission, Washington, D. C.

Heating and Piping Contractors' National Association announces the following appointments on the Board of directors of the National Trade Extension Bureau: Horace W. Jones, Rochester, N. Y.; R. Templeton Smith, Pittsburgh; and V. L. Sheldon, St. Louis. The following have been appointed to serve on the association's Committee on Standardization for three years: Ralph S. Franklin, Boston; and Richard A. Wolff, New York.

Westinghouse Electric & Mfg. Co., plants at East Pittsburgh and South Philadelphia, entertained more than a score of the country's leading educators during the summer at conferences designed to give the professors a broader viewpoint of the industry as a whole and better equip them for teaching their respective studies. Specialists conducted conferences on all phases of electrical, steam and auxiliary equipment.

Homer N. Calver has been named acting executive secretary of the Association of Public Health to succeed Mr. Hedrich, resigned. Mr. Calver is a graduate in sanitary engineering from the Massachusetts Institute of Technology. During the war he attained the rank of captain in command of a mobile field laboratory.

Chicago, Ill.—A mammoth electric fan 48 in. in diameter was used the past summer by the Commonwealth Edi-

TEN REASONS WHY-

AUTOVENT MOTOR DRIVEN PROPELLER FANS ARE BETTER

1. Motor will operate indefinitely under full load at the correct temperature for highest fan efficiency.
2. Protected motor prevents air containing grease, acids, moisture, grit or other foreign substances from contaminating motor windings.
3. Elimination of costly break downs and burn outs, which in many instances are caused by contamination of motor windings.
4. Motor windings, after years of service, are as clean as when originally installed.
5. Operating expense is reduced to lowest minimum cost.
6. Complete fans are systematically designed, compact, neat appearing, with no awkward, cumbersome or superfluous parts.
7. Guaranteed assurance as to customer's future satisfaction.
8. Guarantee of fan and motor by one company.
9. Highest efficiency obtainable and low power consumption.
10. Quietness of operation, neatness in appearance and ease of installation.

Autovent Fan & Blower Co.
"Dept. H"
730-738 W. Monroe St., Chicago, Ill.

REGISTERED AUTOVENT.

son Co., and the Westinghouse Electric Manufacturing Co., to boost the sale of household electrical appliances in Chicago. The fan was mounted on a Walker electric truck and carried daily through the business and residential districts. A corps of salesmen accompanied the display to take orders and appointments for individual demonstrations.

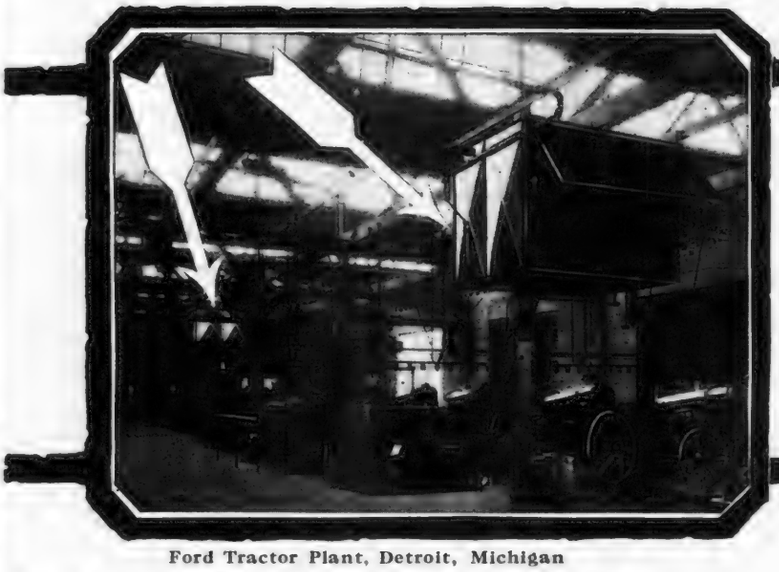
Building Construction in July amounted to $315,024,000 in 36 Eastern States, according to figures compiled by the F. W. Dodge Corporation. This was a decline of 15% over the preceding month and 22% over July of last year. The figures for the month, however, were about equal to the July average for the past four years. Contemplated new work reported during the month amounted to $634,670,000, an increase of 11% over the amount reported in June.

National Safety Council announces that the program of the twelfth annual congress to be held in Buffalo, N. Y. October 1 to 5, 1923, will include 60 sessions of special and general interest to public and industrial safety men. It is announced also that the American Association of Industrial Physicians and Surgeons and the New York State Department of Labor are making plans to hold their annual meetings in connection with the Safety Council and that several joint sessions will be included.

United States Department of Commerce, Washington, D. C. has issued Trade Information Bulletin No. 122, as a supplement to Commerce Reports, containing much information of value to firms contemplating the sending of advertising matter or catalogs to the British Empire. Attention is called to the fact that duties are imposed on catalogs in a number of countries and that the recipients of such matter sometimes have to pay as much as $5 before they actually get the catalog. The department is preparing a series, of which the bulletin on the British Empire is the first, and will gladly mail them upon request to the Foreign Tariffs Division of the Bureau of Foreign and Domestic Commerce.

National Exposition of Chemical Industries, to be held at Grand Central Palace, New York, September 17 to 22, 1923, has issued a call for leading exhibitors for motion picture films showing some phase of the chemical,

To The Man Who is Interested In More Heat for Less Money ...



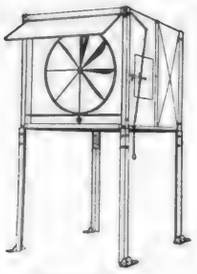
Ford Tractor Plant, Detroit, Michigan

When a mammoth organization like the Ford Tractor Plant makes three installations of ILGAIR Unit Heaters totaling 54 units, it represents an endorsement of one of this country's foremost Industrial plant engineers.

A Valuable Book *for* Architects and Heating Engineers

Showing How to Keep the Heat Circulating at the Floor Level

Sent on Request



Floor Type
Note Ceiling Type in Picture

HIGH EFFICIENCY ILG VENTILATING MACHINERY

Ventilation FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS · RESTAURANTS · THEATRES · HOUSES · ETC ·

ILG ELECTRIC VENTILATING CO. 2858 NORTH CRAWFORD AVE. CHICAGO

BRANCHES IN ALL PRINCIPAL CITIES

One of many Carrier Air Washers at Cadillac Motor Car Co.

Another Cause of Low Production Discovered

For years executives have puzzled over the relatively low production obtained from highly skilled workmen, specially built tools and competent management.

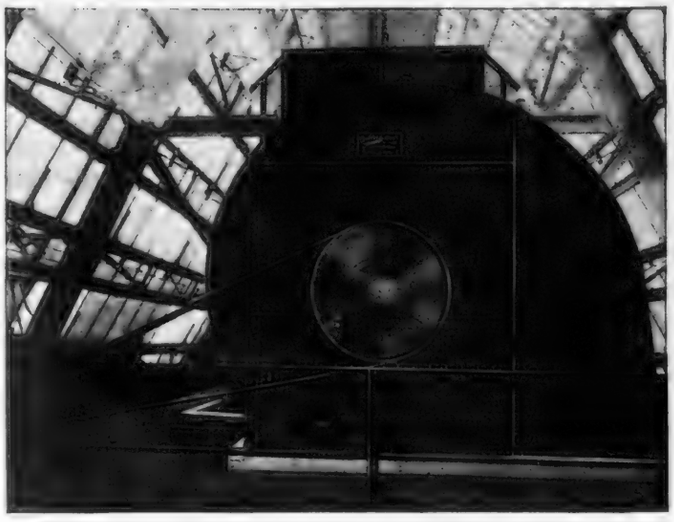
Then the men were found unconsciously slowing down in partly bad air, universally accepted as part of the job.

Speediness replaced sluggishness in exact proportion to the *bracing quality* of the air supplied the workmen.

What was really needed was air with the tonic and stimulating effect noticed after a summer storm.

Buffalo Fans and Carrier Air Washers

were installed to give this healthy condition by the Ford Motor Co., Cadillac Motor Co., Studebaker Corp., Packard Motor Co., General Electric Co., National Acme Co., and very many other well known leaders of modern industry.



15 of these Buffalo Fans supply a million cu ft. of fresh air per minute in Ford Foundry at River Rouge.

The results were amazing. Production records established one day were broken the next—they in turn fell—costs were everywhere cut in proportion.

Our engineers will be pleased to give non-obligating assistance. Please write Department No. 36.

View in one of 15 National Lamp Works of General Electric Co.-plants that have Carrier Air Washers.

Buffalo Forge Company

480 Broadway Buffalo, N. Y.

chemical consuming, equipment or allied industries, to be shown during the exposition.

Chamber of Commerce of the United States has issued an appeal to business organizations to aid in absorbing into industry the 3,000 of 4,000 disabled war veterans who complete their government training courses monthly. "The government can only rehabilitate and train the men up to the point of employability," the appeal stated. "From this point the employment interests of the country must carry on."

Washington, D. C.—The Chamber of Commerce of the United States has published a pamphlet explaining the methods employed by the Bridgeport Brass Company, in educating industrial employees in the fundamentals of business economics and in the details of the business in which they are employed. The pamphlet was issued by the Fabricated Production Department of the chamber and contains a plea for similar efforts by other industries, written by Carl. F. Dietz, president of the Bridgeport company. Copies of the booklet will be mailed upon inquiry to the chamber.

Philadelphia, Pa.—Powell Evans of the tin plate and metal house of Merchant-Evans Co., Philadelphia, has announced his candidacy for mayor of Philadelphia, promising that if elected he will resign from his business connections and devote his entire time to giving the city a business administration. He has long been a leader in community enterprises.

"Standards of Quality are essential for the free interchange of commodities in commerce beyond the stage of first-hand transactions in which personal observation and opinion govern" a pamphlet just issued by the Chamber of Commerce of the United States declares, urging voluntary establishment of standards of quality in industry.

The World Power Conference, initiated by the British Electrical and Allied Manufacturers' Association, to be held next summer in London, in connection with the British Empire Exhibition, has announced a program which is all-inclusive of the sources of power, nationally and internationally. More than a score of American engineering technical and industrial organizations have appointed representatives to a Committee of Arrangements to plan American participation in the conference. The conference is considered the first effort toward a systematic study of the world's power resources and their utilization.

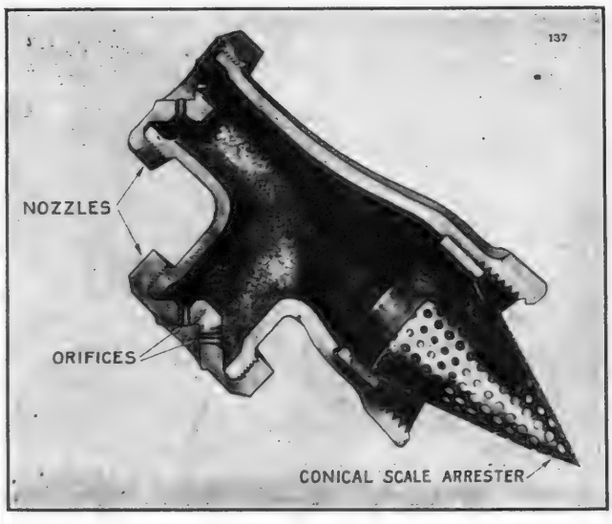
Manufacturers' Notes.

American Radiator Co., Buffalo, N. Y., is one of the bidders at $765,000, for the Curtiss-Elwood airplane plant in Buffalo. Only one other bid was submitted.

Autovent Fan & Blower Co., Chicago, Ill., has appointed Phillip R. Simmonds as its representative in New Jersey to handle the Autovent line of propeller fans and louvres and Uniblade pressure and volume blowers. His headquarters will be at 301 Chadwick Ave., Newark. Mr. Simmonds will be affiliated with the company's New York representative, the Corte Engineering Co., 5303 Woolworth Building. The appointment of Mr. Simmonds, it is stated, is for the purpose of co-operating more closely with the heating and ventilating contractors in New Jersey, Mr. Simmonds having had a wide experience along ventilating lines.

Sarco Co., Inc., New York, has appointed Clement Wells, New York, president, and George H. B. Burke, Western sales manager, Chicago, vice-president of the company. E. J. Ritchie, New York, is on the board of directors.

American Schaeffer & Budenberg Corporation, Brooklyn, N. Y., is the new name of the Schaeffer & Budenberg Mfg. Company and the American Steam Gauge & Valve Mfg. Company. Since the company took over the American Steam Guage & Valve Mfg. Company, the latter has been operated until now as the American Steam Guage & Valve Mfg. Company division of the Schaeffer & Budenberg Mfg. Company. The company makes a wide variety of indicating and recording instruments and steam specialties, including the American Ideal steam trap.



THE IMPACT AIR WASHER

The cut indicates a longitudinal section through a spray head, showing the two impact nozzles with their smooth, round orifices, entirely devoid of obstructing vanes or spiral passages. The conical scale arrester, with its numerous holes, each smaller than the nozzle orifice, intercepts and retains all dirt and scale large enough to plug the nozzles. During this slow accumulation the nozzles spray at full capacity.

Ask for Booklet K.

THE COOLING TOWER CO., Inc.

15 John Street, New York

AIR Engineering Service

The American Blower Company offers the cooperation of a competent Engineering department in the solution of any problem along the following lines:

HEATING
VENTILATING
AIR WASHING
FANS AND BLOWERS
EXHAUST FANS

American Blower service and mechanical equipment represents the development of forty successful years. Write for descriptive Bulletins.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, WINDSOR, ONT.
(330)

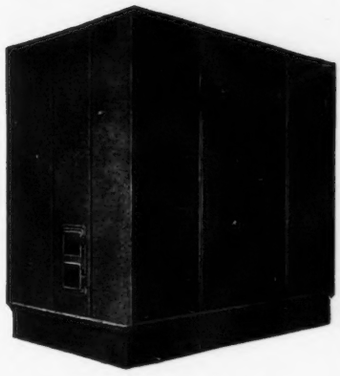
American Blower
Sirocco
EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

Peerless Ventilator

BUILT RIGHT RUN RIGHT

The New York Blower Co.

Chicago, Ill. **La Porte, Ind.**

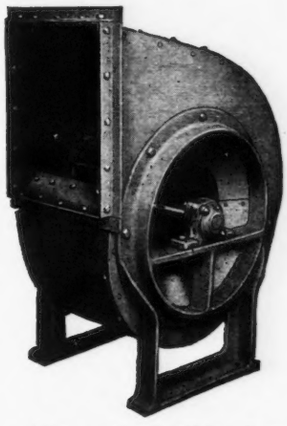


Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.

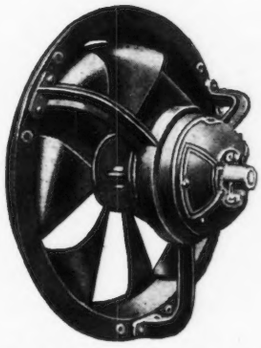
Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from ar installation for your special problem we will frankly so state.



Motor Driven Propeller Fan

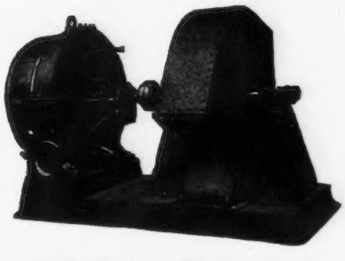
Slow Speed Planing Mill Exhauster

The New York Blower Co.

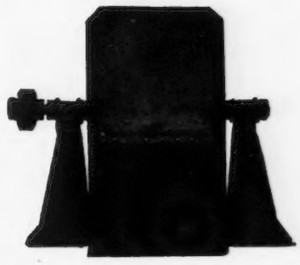
Chicago, Ill. **La Porte, Ind.**

Branch Offices in Principal Cities

High Speed Type "C" Seri-Vane Fan

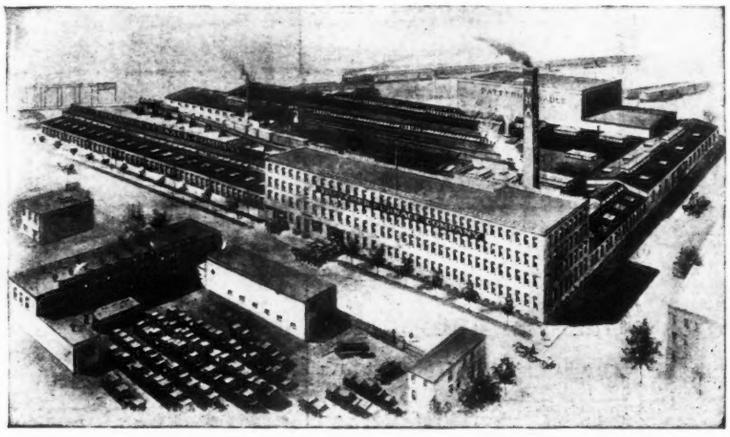


High Pressure Blower Direct Connected to Turbine



Stoker Fan

Thatcher Furnace Co., Newark, N. J., has now completed the establishment of its general executive offices in the new Thatcher Building, 39-41 St. Francis St., at the Newark plant. The change recalls the fact that the Thatcher company has served over three generations. The company was founded in 1850 by J. M. Thatcher. The original Thatcher plant in Newark was a small frame building. A comparison of the picture of this building with the Thatcher Newark plant as it is today tells in a graphic way the story of the company's progress. Another Thatcher plant in Garwood, N. J., is taking care of the demands of increased business. The company's sales rooms in New York, at 133-135 West 35th Street, will be maintained.



Enlarged Plant of the Thatcher Furnace Company in Newark, N. J.

Richmond Radiator Co., 1480 Broadway, New York, has awarded a contract to the Truscon Steel Co., Youngstown, O., for a one-story addition, to cost $50,000.

Pierce, Butler & Pierce Mfg. Corp., New York, has purchased the mill, railway and heating and plumbing supply businesses of the Savannah Supply Co., in both Jacksonville, Fla., and Savannah, Ga. The branches will be continued under the general direction of H. A. Butterfield.

Minneapolis Heat Regulator Co., Minneapolis, Minn., has established a branch office at 400 Watkins Bldg., 228 Third St., Milwaukee, Wis., in charge of Wm. F. Arnold.

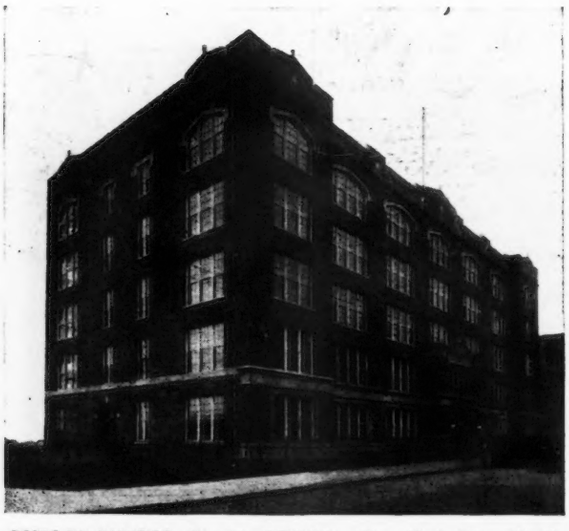
C. A. Dunham Co., Chicago, has opened a branch office at 304 Smith Bldg., Sioux Falls, S. D. W. C. North, formerly of the Washington D. C. branch, is in charge of the new office.

United States Radiator Corp., Detroit, Mich., is building two additions to its Detroit plant, at an estimated cost of $100,000.

Abram Cox Stove Co., Philadelphia, Pa., has opened a new show-room at 113 East 34th St., New York. James Lyttle and Arthur R. Glore have charge of the new venture, with R. J. Kingsbury, Hersey Girvan, Joseph L. Weinert and Al Milne representing the company's New York office. Daily trucking service has been arranged between the factory at Philadelphia and New York.

H. Mueller Mfg. Co., Decatur, Ill., has purchased property at 2450 Hunter Ave., Los Angeles, Calif., and will erect a factory and branch office there. The company has recently completed an office building and warehouse in San Francisco, Calif.

Detroit Lubricator Co., Detroit, Mich., has moved its Chicago office from the Tribune Bldg., to 820 Michigan Boulevard.



PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools

LEHIGH MULTIBLADE FANS

FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

HERSH BROTHERS CO.

654 Mill Street **ALLENTOWN, PA.**

Class Attention!

— fresh air in abundant quantities makes alert, healthy students

and

— fresh air is always assured by the reliable operation of Westinghouse motors and control for heating and ventilating equipment.

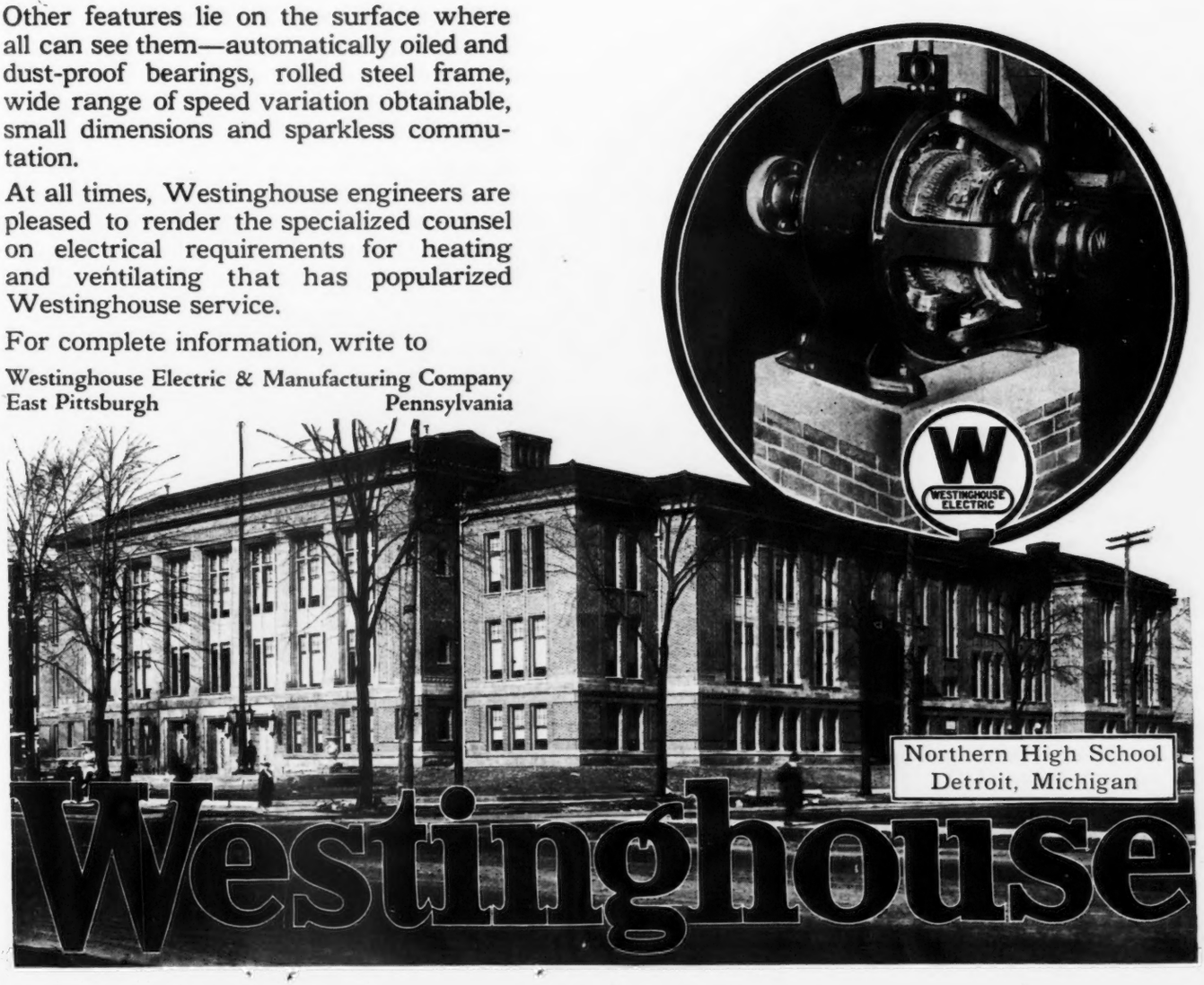
MOST of the elements of construction and design responsible for the excellence of Westinghouse motors and control for heating and ventilating equipment lie hidden deeply where even an expert can hardly trace them—the proportion of bearings and shaft, quality of insulation, cool operation, absence of local hot spots and similar features.

Other features lie on the surface where all can see them—automatically oiled and dust-proof bearings, rolled steel frame, wide range of speed variation obtainable, small dimensions and sparkless commutation.

At all times, Westinghouse engineers are pleased to render the specialized counsel on electrical requirements for heating and ventilating that has popularized Westinghouse service.

For complete information, write to

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania



New Incorporations.

American Steam Specialty Corp., 206 Broadway, New York, capital $10,000. The officers will be announced later. L. J. Hamel, 206 Broadway, is representative. They will manufacture steam valves.

Connecticut Blower Corp., Hartford, Conn., capital $250,000. Officers: M. E. Keeney, president; C. H. Keeney, treasurer; and C. E. Keeney, secretary. The new company has taken over the International Blower Co., and the Hartford Sheet Metal Works, manufacturing and installing blowers and exhaust fans, ventilating systems and blower systems of all kinds.

Anderson Plumbing & Heating Co., Brockton, Mass., capital, $25,000. Incorporators: Reuben E. Anderson, Timothy P. Sullivan, and Abbie A. Russell.

Lehigh Fan Co., Allentown, Pa., to take over the fan manufacturing department of Hersh Brothers Co., Allentown.

McCrary-Robinson Co., Third and Tennessee Sts., Pine Bluff, Ark., capital $25,000. Incorporators: George A. McCrary and Adam J. Robinson. They will deal in heating and plumbing supplies.

A. L. Devoe & Co., 122 Roseville avenue, Newark, N. J. Officers: A. L. DeVoe, president, C. Vickerstaff, treasurer, and Frank J. McNally, secretary. They will engage in business as jobbers of heating and plumbing supplies.

Costar Heating & Plumbing Co., Charlotte, N. C., capital $20,000. Incorporators: L. B. Costar, L. E. Palmer, and C. L. Whaley. They will conduct a heating and plumbing business.

Century Heating Co., 2118 North Clark St., Chicago, capital $5,000. Incorporators: Walter S. Kehm, Robert J. Kohn, Ignatz Swarts, J. L. Robzell, and Bruce B. Robzell.

New Firms.

Monitor Boiler Co., Finance Building, Philadelphia, Pa., has been organized to manufacture a steel water-tube boiler of the coil type, long in successful use. President, D. W. Ritchey, Philadelphia; vice-president, Robert W. Groezinger, Lancaster, Pa.; treasurer, C. S. Reed, Lancaster; sales manager, W. S. Forrer, Philadelphia.

Merger of Consulting Engineering Organizations

George B. Nichols, consulting engineer, 300 Madison Ave., New York, and the Terrell Croft Engineering Co., of which Terrell Croft is directing engineer, 6600 Delmar Boulevard, University City, St. Louis, Mo., have effected an affiliation whereby the experience and resources of each organization will be available to the clients of the other. Mr. Nichols will act as the principal for projects east of Illinois, whereas the Croft organization will act for projects west of that State. The combination will, as have its components in the past, specialize in mechanical and electrical engineering for power and industrial plants, institutions and buildings.

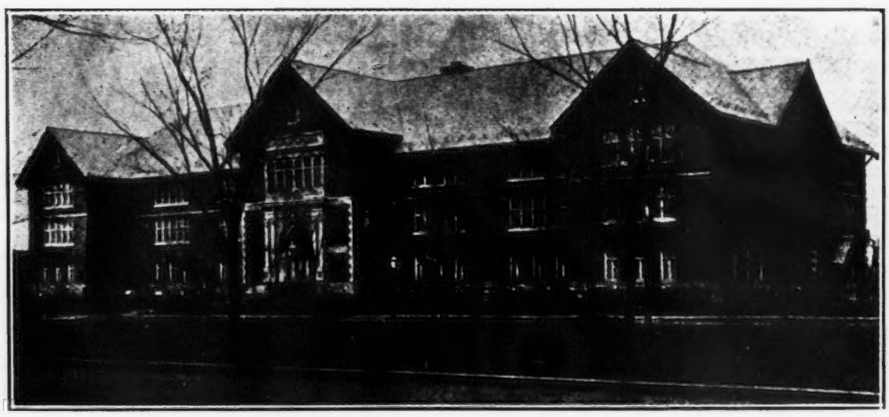
WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

SALES ENGINEER WANTED.—Man experienced in air washer and air conditioning work. State in confidence present connection, experience, salary, age and references. Address Box 91, care of Heating and Ventilating Magazine.

FOR SALE.—The offering for sale of this utility corporation in a live Illinois city at a price settled upon presents an opportunity to investors in a legitimate enterprise seldom met with. In operation less than two years, machinery and equipment in perfect condition, same as new, quality best money can buy, 47-year franchise yet to run with no restrictions, large field for expansion, good prices, splendid rail facilities. To those looking for a safe, sane, profitable investment, we invite correspondence and can show substantial evidence to back our statements. Address Box 92, care of Heating and Ventilating Magazine.

O_3 — A TON OF COAL A DAY WITH ELECTROZONE VENTILATION — O_3



R. M. Milligan, Architect
Commissioner of School Bldgs.

Woodward School, St. Louis

E. S. Hallett, Engineer

The Woodward School, equal to a thirty-six unit building, was heated and ventilated during the severe weather last winter the Electrozone way, on a ton of coal per day. Bulletin V9 gives the details. It's yours for the asking.

THE AIR CONDITIONING & ENGINEERING COMPANY

2914 S. Jefferson Avenue, St. Louis, Mo.

O_3 — O_3